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CONTENTS

		Page
NEEDED RESEARCH IN THE FIELD OF LEARNING	V. A. C. Henmon	313
OVERLAPPING IN HIGH SCHOOL AND COLLEGE	Leonard V. Koos	322
THE SUPERVISION OF TEACHING IN GEOGRAPHY	W. J. Osburn	337
THE VOCABULARY OF HIGH-SCHOOL PUPILS IN WRITTEN COMPOSITION	F. P. O'Brien	344
SOME NEGLECTED PROBLEMS IN CLASSIFYING HIGH-SCHOOL PUPILS	Richard D. Allen	351
NOTES ON THE TEACHING OF ELEMENTARY MATHEMATICS IN COLONIAL AMERICA	Robert Francis Seybolt	359
A BIBLIOGRAPHY OF RESEARCH ARTICLES PUBLISHED IN 1924	E. J. Ashbaugh	368
EDITORIALS		380
REVIEWS AND ABSTRACTS		384
NEWS ITEMS AND COMMUNICATIONS		389
INDEX FOR VOLUME XI		

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JOURNAL *of* EDUCATIONAL RESEARCH

Volume XI MAY, 1925 Number 5

NEEDED RESEARCH IN THE FIELD OF LEARNING[1]

V. A. C. HENMON
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The fundamental problems of education, it will be agreed, are *what to learn* and *how to learn*. All matters of school organization and administration, selection and classification of pupils, methods of teaching and testing teaching, important though they may be, are after all secondary problems. The purpose of studying them and of improving them is to provide the best conditions for economical and effective learning of what society at the time prescribes as necessary or desirable for the educated man. To the reader of current educational literature it is at once evident that a very great share of available research energy and time among scientific students of education is being expended on improving the conditions under which learning will take place, but that, in the meantime, the accurate and careful study of learning processes themselves is being neglected. The editor of an important educational journal recently sent out a plea for papers dealing with experiments on learning, and reported that he had far more than he could possibly use on tests and testing. Educational psychologists, as a group, have thrown down their picks and shovels and joined in the rush to the newer gold fields of intelligence and educational tests. The new fields have added a rich supply of metal and unquestionably needed to be explored, but the older mines are greatly in need of workers.

The neglect of experimentation in learning is not due to the superior attractiveness of testing and classification problems alone,

[1] Paper read before the Educational Research Association at the Cincinnati meeting, February 23, 1925.

but rather to the difficulty and complexity of learning experimentation and the training and preparation needed for successful work in it. Canvass the list of educational psychologists who have done, or are doing, research work in education and almost every one has come up through a long and rigorous training in experimental psychology. Graduate students in education now shy at this training and, quite naturally, seek problems which require less training and which yield more immediately useful results. The educational psychologist himself finds it easier to assign statistical problems involving the giving and scoring of tests, than to supervise the set-up and conduct of a careful laboratory experiment in learning or to arrange for a learning experiment under controlled conditions in a school. He rarely has the time, even if he has the inclination, to participate in or watch closely the course of a laboratory experiment. He finds it difficult to go through the necessary negotiations through the superintendent, the principal, and the teacher for a successful classroom experiment. The inevitable result is surveys, testing programs, and test constructions without end. We conduct skirmishes, forays, and minor engagements, but avoid the real battle.

When one attempts to outline the needed researches in the general psychology of learning, and in the special psychology of learning school subjects under school conditions, the problems become so numerous that it is difficult to know where to begin and where to leave off. The whole field is fallow. Certain major lines of study may be indicated for illustrative purposes.

Particularly urgent and important are studies of pre-school learning. The great significance of the pre-school period is indicated by the experimental work on infants by Watson and others, by the application of the methods of psycho-analysis, and by the success of nursery schools in England. The experimental work on infant behavior and the conditioning of reflex, instinctive, and emotional responses are revising our notions of the original nature of man and throwing new light on learning processes. It is significant as an indication of the backwardness

of educational psychology in this field that Baldwin, in his new book, should be able to refer to an experiment in card-sorting with fifty-six children ranging in age from twenty-nine months to seventy-four months as "what is probably the first learning experiment for a considerable number of pre-school children." The period which Watson surmises to be perhaps the most important period—namely, that between the tenth month and the close of the second year—is still untouched. We know something, but not a great deal, about the way conditioned responses are set up in children, but I know of but one study dealing with the equally important problem of breaking up conditioned associations.

Darwin's wise observation that "we do not really understand a thing until we know how it came to be what it is" applies aptly to the learning processes. Institutions possessing medical schools with maternity hospitals have an obligation to carry on researches in the learning processes of very young children. From all indications now a great many of the behavior tendencies which we formerly regarded as inborn may be acquired tendencies built up in the pre-school period. If this is the case, it means a revision of a lot of our educational theories and practices. To my mind, there is no field more fertile or more important than pre-school experimentation.

For the general psychology of learning of school children and adults the lecturer on educational psychology must fall back on curves of learning telegraphy and typewriting. He must seek to derive general principles from such unimportant functions as ball-tossing, mirror-writing, substitution experiments, and the like, and to make such applications of these principles as he can. For more complex learning activities we still resort to the solution of puzzles for light. Curves of learning the things teachers are interested in, either by adults or by children, in the laboratory or in the school, are very rare. The result is that teachers do not find the educational psychology they study functioning in their practice. It is idle to say that this is due to failure on their part to make the necessary applications of psychological prin-

ciples. The so-called psychological principles often rest on too slender a basis for safe application. Moreover, scientific research is a continuous warning against hasty generalizations and applications. Why should we not have curves of young children in learning to read, write, spell, and count, and of older children in learning to read, write or speak a foreign language or in learning geometry instead of generalizations from the curves of adults in learning nonsense syllables, mirror-writing, or puzzle-solving? Thorndike pointed out in 1913, "It is a noteworthy commentary on the newness of scientific study of education that nobody has yet measured the actual progress of any single child in learning any single school subject for over a month, or in learning any of the informational subjects for even a week." The statement is just as true now. Clearly, there are here a host of problems crying out for experimentation and research.

The study of the factors and conditions that affect learning have been studied in some detail since Ebbinghaus reported his important experiments in 1885. For the most part, however, the investigations have centered about rote learning, in which students of education are relatively little interested, while logical learning or study, in which they are vitally interested, has received scant attention.

Even the alleged laws of rote learning are imperfectly established. Take any group of representative texts in psychology and examine closely the chapters on memory and learning and you will find much that is contradictory. The statements on learning by wholes and by parts are not in accord and the practical suggestions derived from them vary with the opinions of the writers and the weight they attach to this or that set of experiments. The principle of distributed repetitions, apparently so well established, has been tested in only a few of the many permutations and combinations that are possible. It has been tried out in relatively simple forms of sensori-motor or rote learning with but little application to the learning of either tool or content subjects.

The consequences of the principle of distributed repetition are not discoverable in our school practices. Ask any group of intelligent teachers whether it is better to study a subject for two hours throughout a year or for four hours a semester and you immediately start an endless debate. The North Central Association has, for many years, stoutly maintained as a standard unit, the pursuit of a subject for five forty-five minute periods a week for thirty-six weeks in utter disregard of the questionable psychology on which it rests and without any experimentation to determine its validity. The split-unit program, in any form, has been vigorously combated in spite of the fact that the psychology of learning would tend to support it and that many of us survived it without demonstrated loss.

The textbook statements on the rate of reading in learning are contradictory and the authors make common sense observations which do not accord with the experiments they report. The statements on the value of various modes of presentation vary unbelievably in the face of experimentation. The effect of increasing length of series on the time of learning and retention is presented in terms of Ebbinghaus' early results in spite of the fact that several investigators find entirely different results and in spite of the fact that Ebbinghaus' results cannot possibly be reconciled with other well-established facts. The principle that repetitions carried beyond the point of first learning are as valuable as those in the early stages and hence that the value of repetitions is directly proportional to their number is hard to reconcile with practical common sense observations and with what we know of the facts of diminishing returns from practice.

No one has repeated Ebbinghaus' important experiment on the effect of overlearning or studied its operation on other material than nonsense syllables. The optimum combination of recitation, or recall, and repetition in learning has been examined in only a fraction of the possible combinations with different materials, varying subjects, and varying stages of learning. The relative strengths of progressive and regressive associations have been tested in the learning of nonsense syllables, but in such

practical matters as learning foreign-language vocabularies or number combinations there is almost nothing to offer.

Forgetting—perhaps as important an art in our mental economy as the art of learning—has been studied in a half dozen researches with only a small fraction of the field touched. Is the evidently greater permanence of retention in sensori-motor functions, than in strictly mental functions, merely a matter of more overlearning or may it be that the older, more fundamental sensori-motor functions are, as Thorndike suggests as a possibility, inherently more readily retentive? If the latter alternative were true then sensori-motor accompaniments in the learning process would always be desirable and our whole educational practice might be profoundly affected. How much loss in efficiency and in improvement comes from the long summer vacation and how long a time is required to bring about in September and October a restoration of June efficiency? Teachers variously estimate with different subjects that they spend from a month to six weeks in bringing children up to the levels at which they left off in June. The bearings of experiments on this problem, of which there are almost none, on the length of the school year, the distribution of vacation periods, and the all-year-round school are clear.

Thorndike lists ten psychological conditions of improvement, few of which have been studied experimentally. The literature of opinion on problem projects, supervised study, motivation, and definiteness of assignments grows apace, but there is little experimental evidence of their bearings on learning. Experimentation is not easy in these fields and hence they are avoided in favor of less difficult, but also less important, problems.

If it is thus possible to point out how far we are from satisfactorily established psychological principles in rote learning, it is scarcely necessary to observe that, in logical learning, we are still further removed. Few important researches in analytic and selective learning are on record and almost everything needs to be done.

No less significant are needed researches into the way in which acquired likes and dislikes and sentiments are built up out of simple feelings and emotions. In fact, they are perhaps more important than anything else we could do. The psychology of the feelings and emotions has been the dark continent of psychological exploration. We should, no doubt, all agree with President Eliot that the world is still governed by sentiment and that education consists more in developing right sentiments than anything else. We should perhaps also agree with Oscar Wilde that "the intellect isn't a serious thing and never was; it is merely an instrument on which we play." When we theorize about education we state its functions to be to impart knowledge, train in skills, and form character, and then go on to declare that the formation of character is the fundamental or ultimate aim. In our practice, however, we direct our attention to imparting knowledge and training skill, hoping that character will accrue as a by-product. We make knowledges and skills sacrosanct in practice in the same breath that we designate them as secondary matters. Character and character traits are matters of the feelings and emotions. Watson's dramatic experiment in the setting up of conditioned emotional responses suggests the way in which a host of our acquired likes and dislikes and sentiments are built up and opens a large field for experimentation. So long as we regarded the feelings and emotions as independent, conscious elements *sui generis* there was little prospect of significant experimentation. Now that we tend to regard them as of a piece with reflexes and instincts the possibilities of practically important experimentation are much greater. A concerted drive on the natural history of our affective dispositions and methods of controlling them is our next really great field of research.

The iconoclastic observations of Thorndike and Watson on mental work and fatigue indicates how much needs to be done. Watson's proposition that "Probably the most essential thing for the beginning student to do or for any scientific man planning to do research in the field of human work is to neglect most of the general discussions which have gathered about fatigue," and

his characterization of the literature from the standpoint of discussion as "complex and confusing and worthless" would throw open the whole field of the human organism at work for renewed research. Since the experimental work of Sikorsky in 1879 there has been, perhaps, more practical school experimentation in fatigue than in anything else. A large share of this work has been dominated implicitly by the notion that one starts a day with a given quantum of energy in reservoir and that a depletion of this energy, which only rest, sleep, and food can restore, results from mental work. The practical inferences from such experiments on the fatigue values of school subjects, arrangements of programs of studies, length of periods of work, and length of pauses, are probably all without sound justification. Here are scores of problems awaiting careful investigation.

The second major field of educational psychology, namely, the special psychology of learning school subjects under school conditions bristles with unsolved problems. Notable experimentation has been carried on in the psychology of arithmetic, handwriting, and algebra, but in other subjects there are, for the most part, only minor researches. The wide variance in definitions of ability to read indicates that we are not clear as to the underlying psychology of reading. No one is satisfied, for example, with our present measures of speed of reading and we know very little about the relationships between speed and comprehension. Recently, I have had occasion to study a case of chronic bad spelling coupled with a high general intelligence. No one can examine the literature and not be impressed with the inadequacy of our present knowledge of the psychology of spelling. There is a voluminous literature of opinion and controversy on methods of teaching foreign languages, but amazingly little on the underlying psychology of learning foreign languages. In the informational subjects we have, as everyone knows, not even made feeble beginnings.

The art of learning is the most important art one can acquire, but it is nowhere adequately taught and cannot be adequately taught. For one book on methods of learning we have scores

on methods of teaching. The latter are almost always flat, stale, and unprofitable, the dullest reading the student of education has to face, except possibly that on principles. It will continue to be so until our psychology of learning is more advanced. In recent years, large sums of money have been invested by various endowments, funds, and corporations in educational research. Some one should call to the attention of the administrators of these vast resources that at least a major part of these funds should be expended on the really fundamental problems of education and not on secondary or minor problems, as is now so often done.

We are witnessing, these days, a widespread revival of interest in the question of what knowledge is of most worth, or, of what to learn. Committees by the hundreds are engaged in activity analyses and curriculum making. We need a revival of interest in the other half of the educational problem, how to learn. We talk glibly about laws of learning and psychological principles, which are rarely laws or principles in the true sense of the terms.

OVERLAPPING IN HIGH SCHOOL AND COLLEGE

LEONARD V. KOOS
University of Minnesota

Something of the better type of thinking which characterizes a not uncommon belief that high-school and college work overlap[1] each other is illustrated in the following quotation:

> The wealth of subject-matter offered in a high-school curriculum today often hopelessly outruns any possibility of mastery by a given pupil within a four-year period and much therefore remains untouched which the student may possibly wish to attack at a later point in his career. The college has been willing in increasing degree to satisfy this demand and as a result we find a wide range of identical subjects taught in school and college. The mere fact that the two varieties of institution offer the same work is not itself conclusive evidence of waste, but a careful study of the situation leads one to question whether the present practice is really defensible in all its aspects.
>
> . . . . we may well remember that our colleges pursue two lines in their practice with regard to the school work which they duplicate. In the one case they do the seemingly obvious thing and after a student has covered certain ground in school he is permitted to proceed in college to the next more advanced stage of the same subject. Work in the modern languages may illustrate this case. But in the second instance, where the colleges offer work which is nominally identical with that done in the schools and entrance credit is given for the same, the student, when once he is safely inside the college walls, finds himself set to doing right over again much which he has already done in school. This procedure is frequently justified on the ground that the work is carried on in college from a more mature and advanced point of view. Certain courses in science both physical and biological may illustrate this case.[2]

In addition to expressing his conviction that high-school and college offerings overlap each other, Dr. Angell has here offered at least one explanation. He has not, however, touched on the *historical* or *originating cause* of the duplication, namely, that

[1] Based on the report of an extended study in Koos, Leonard V., *The Junior College*. Minneapolis, University of Minnesota, 1924. Vol. II, pp. 387-531 (Research Publications of the University of Minnesota, Education Series No. 5).

[2] Angell, J. R. "The Duplication of School Work by the College," *School Review*, 21:1-10, January, 1913.

much of the present high-school curriculum has been inherited from the college above. The ancient languages and literatures are the only fields in which there has been no consistent downward shift. Such courses as beginning modern languages, the history of English literature, mathematics, the sciences, and even courses in the philosophical group have joined in this downward movement.

Some of these subjects, after first shifting to the freshman college year, have not only appeared later in the high-school grades, but have become part of the requirements for admission to college. Among the high-school subjects formerly parts of college offerings are elementary and higher algebra, plane and solid geometry, French, German, history of English literature, rhetoric and composition, physics, chemistry, botany, zoology, history, and economics. Moreover, a comparison of older college textbooks with present-day high-school manuals shows that the process of lowering has often been accompanied by an enrichment rather than an improverishment of the courses. In a very significant sense, therefore, the high school has become the "people's college."[3]

In this article we shall illustrate the extent and character of the overlapping of college on high school by reference to two subjects, namely, *chemistry* and *economics*.

Chemistry

The twenty-six high schools represented in this study are located in cities of 10,000 and over in six North Central states. Forty-one higher institutions are represented, all but four of them being of the separate college type, namely, colleges not connected with university organizations. They are located in the same general region, but they are scattered over eleven different states.

The high-school courses in the first of these fields bear such names as "chemistry," "elementary chemistry," "general chemistry," and "beginning chemistry," with a scattering of other

[3] The reader who desires a more complete description of this depression of collegiate subjects is referred to Koos, *op. cit.*, chap. XVI-XVIII.

titles. The college courses bear the names "general inorganic chemistry," "general chemistry," "Chemistry I and II," and "elementary chemistry," the last two titles appearing much less frequently than the first two. Almost all courses represented both in high school and college extend over a full school year. The number of recitation and laboratory periods per week tend to be identical in the two institutions; but in the aggregate the colleges devote somewhat more time to the courses because of longer periods.

The data assembled concerning the classification of students who take the high-school course corroborate those of other investigations showing that chemistry is predominantly pursued by Seniors, although also often taken by Juniors. On the other hand, students in these first college courses are generally Freshmen, although sometimes they are Sophomores. We have, therefore, in this instance a subject which is taken predominantly by those in the last year of the lower and in the first year of the upper unit. This situation, combined with the approach to identity in titles and duration of courses, suggests a large measure of identity of content.

The principal basis for comparing the content of high-school and college courses in chemistry is the textbooks and laboratory manuals the use of which was reported by the heads of departments. This procedure has its justification in the fact that deviations from such materials are not at all commonly made. That is to say, the textbook and laboratory manual constitute the content of the course.

The two larger headings under which the content has been divided are *Common Elements* and *Other Subdivisions*. *Common Elements* is subdivided into (1) occurrence, (2) preparation, (3) physical properties, (4) chemical properties, (5) history, (6) uses, (7) preparation of compounds, (8) description of compounds, and (9) uses of compounds. *Other Subdivisions* are (10) rarer elements, (11) organic compounds, (12) processes, (13) principles, (14) chemical laws, (15) definitions, (16) questions, (17) problems, and (18) summaries and restatements.

From what is generally known about the total amount of content in the two groups of textbooks, it would not have been difficult to predict that the college texts would have more material in many of these subdivisions. This prediction is borne out by our examination of the two college and three high-school texts in most common use. The average number of lines devoted by

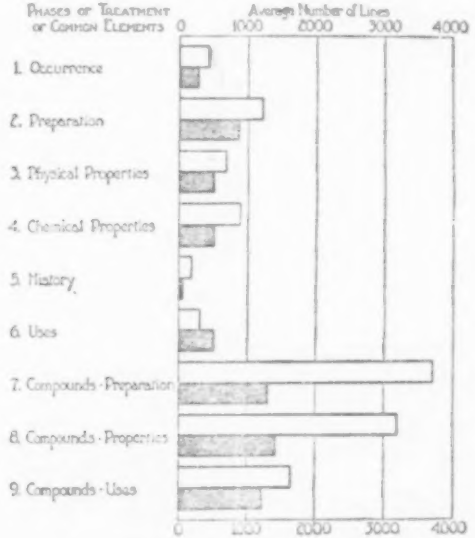

FIGURE 1. AMOUNT OF SPACE DEVOTED BY HIGH-SCHOOL AND COLLEGE TEXTS TO THE SUBDIVISIONS OF *Common Elements* IN CHEMISTRY (IN OUTLINE, COLLEGE; SHADED, HIGH SCHOOL)

these texts to each of the various subdivisions is given in Figures 1 and 2. In all but four of the eighteen subdivisions the numbers of lines in the college texts exceed those in the high-school texts. The exceptions are *Uses of the common elements, Organic compounds, Questions,* and *Summaries and restatements.* The exception in the case of *Organic compounds* is to be explained by the fact that the college courses are more often designated as general inorganic chemistry than are the high-school courses—a fact which indicates that the high-school courses aim to be more

general in character than do the college courses. The larger amount of space given in the high-school texts to *Questions* and to *Summaries and restatements* indicates a greater emphasis upon pedagogical devices in the texts used in the lower unit. The largest differences in favor of the college texts are in *Preparation* and *Properties of compounds, Rarer elements, Processes, Principles*, and *Definitions*. Despite the differences, however, all subdivisions are represented in both college and high-school texts.

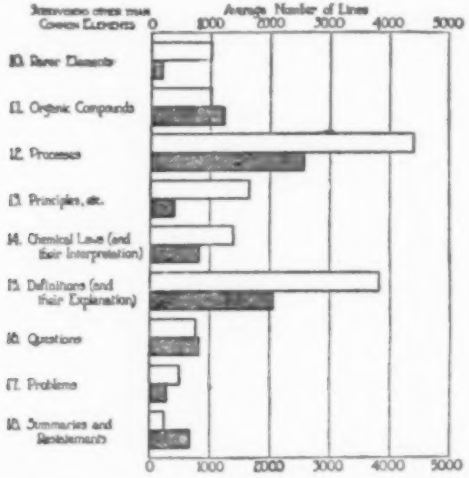

FIGURE 2. AMOUNT OF SPACE DEVOTED BY HIGH-SCHOOL AND COLLEGE TEXTS TO CERTAIN OTHER TYPES OF MATERIAL IN CHEMISTRY (IN OUTLINE, COLLEGE; SHADED, HIGH SCHOOL)

The percentage distributions (Figures 3 and 4) tend to emphasize the similarity between the two types of courses more than do the data setting forth the actual space assignments in equated lines. The notable differences in favor of the college are reduced to four, namely, *Preparation of compounds, Properties of compounds, Rarer elements*, and *Principles*. On the other hand, on the percentage basis one subdivision, *Uses of compounds*, is added to those in which high-school texts have an excess.

As far, therefore, as is to be concluded from the analysis of texts, it may be said that, although college texts are more extended than high-school texts, the relative recognition of the several subdivisions does not differ widely, excepting that the former stress compounds (especially their preparation and properties), the rarer elements, and principles more than do the latter, while the latter make more of uses (both of elements and

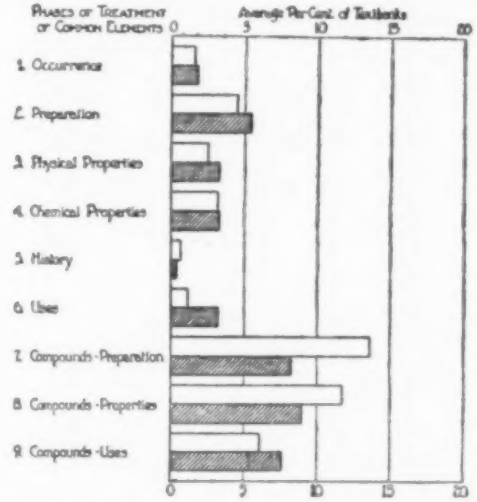

FIGURE 3. PERCENT OF SPACE DEVOTED BY HIGH-SCHOOL AND COLLEGE TEXTS TO THE SUBDIVISIONS OF *Common Elements* IN CHEMISTRY (IN OUTLINE, COLLEGE; SHADED, HIGH SCHOOL)

compounds), organic materials, and pedagogical features such as questions and summaries. Furthermore, the similarities far exceed the differences.

It will be pertinent to illustrate the nature of some of the differences found. The chief difference in favor of the college texts under the main heading, *Common Elements*, appears in the subdivisions dealing with *Compounds*. For instance, the mean number of compounds of sulphur mentioned in the college texts is 21; in the high-school texts, 9.6. For nitrogen the means are 13 and 8; and for iron, 19 and 11.6, respectively. The

difference in the matter of the *Rarer elements* may be made clear in brief space by stating that, while one college text refers to at least 22 and the other to at least 20 such elements, the high-school texts refer to a much smaller number. Radium and helium are the only two of these elements discussed in all of the five texts analyzed.

If four of the subdivisions—*Processes, Principles, Laws,* and

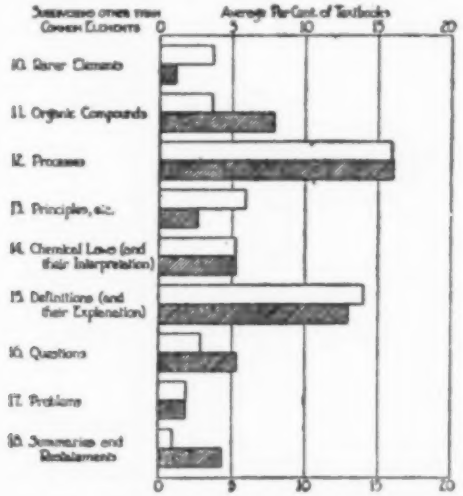

FIGURE 4. PERCENT OF SPACE DEVOTED BY HIGH-SCHOOL AND COLLEGE TEXTS TO CERTAIN OTHER TYPES OF MATERIAL IN CHEMISTRY (IN OUTLINE, COLLEGE; SHADED, HIGH SCHOOL)

Definitions—are considered together as constituting the more theoretical portions of the courses in chemistry, the average percent of the total content devoted to them is found to be forty-one for the college texts and thirty-seven for the high-school texts. The theoretical portions of the college texts can thus be said to exceed those of high-school texts by four percent—an appreciable, but hardly an extraordinary difference.

Additional evidence as to the amount of likeness and difference between high-school and college texts is yielded by a comparative study of the illustrations to be found in them. The

averages are almost the same, being 159 for the college texts and 164 for the high-school texts. If the extent of overlapping of illustrations in the two groups of texts is computed—the illustrations being regarded as identical if they portray similar apparatus and are used to convey the same principle—it is found to include roughly three-fifths and two-thirds of those appearing, respectively, in the college and high-school books.

A count of the different experiments to be found in the laboratory manuals prepared to accompany the five texts analyzed results in a total of 99. Of these, the two college manuals have 79 and 85, or a mean of 82. The mean for the three high-school manuals is 75⅔, or only 6⅓ less than the college average. This count of experiments does not, however, do full justice to the difference in laboratory material, for the difference is somewhat accentuated when the comparison includes a consideration of sub-experiments or portions of experiments. Data on this point, space for the presentation of which cannot be spared, give ground for the belief that, although there is much overlapping in the larger features and content of the experiments, the more extended detail in the college manuals means a more thorough-going experimental exploration of the fields represented.

Reverting to overlapping computed in terms of space assigned to the large experiment heads, let it be said that the average percents turn out to be 73 for college and 68 for high-school experiments. When to these amounts and percents are added those of experiments found in both groups but not in *each text* of both groups, the totals amount to almost all the exercises, roughly 99 and 95 percent for college and high-school manuals, respectively. This leaves only about one percent of the experiments peculiar to college manuals and five percent peculiar to high-school manuals. The larger percent of materials distinctive of the high-school manuals arises from the desire to emphasize the "practical" in the experiments as well as to make the course more general by introducing simple experiments in the organic field. Even when allowance is made for the larger number of sub-experiments introduced in the college manuals, it must be admitted that the laboratory portions of college and high-school

courses in chemistry resemble each other vastly more than they differ—that they cannot be far from identical in major aspects.

Some of the facts already given in describing high-school and college courses in chemistry point to appreciable, and in some instances notable, quantitative distinctions. A few others may be added. The average number of equated lines in the high-school textbooks is 15,875; in the college books, 27,343. The average number of topics—the term topic referring to each common element, each rarer element, each process, and the like—per high-school text is 261.3; and the average per college text is 306.5. The average number of lines per topic is, for the high-school books, 60.7; for the college books, 90.0. The median number of pages of text per clock-hour of recitation or lecture is 7.9 for high schools and 9.2 for colleges, showing a difference less marked than might be expected from the measures of gross content just presented. The reduction is accounted for by the considerably larger number of clock-hours of instruction in the college courses.

It is clear from the comparisons made that, although there are some differences between high-school and first college courses in chemistry, the courses are in reality much alike. Consequently, if the materials presented in high-school courses may be presumed to be secondary in character, there is relatively little in these first college courses which is not also secondary. Moreover, if a student takes the course in general inorganic chemistry in college after having had the high-school course—as students often do—he is repeating almost all of it. Even in the few institutions where the student may enter a course in general inorganic chemistry administered for those who have had high-school chemistry, there must be a large amount of repetition.

Economics

The high-school and college courses in economics are taken by students typically two school years apart in classification; but the total amount of instructional time devoted to them does not differ widely. We should expect the first of those facts to

lead to difference between the courses and the second to similarity. A comparison of the courses, paradoxical as the statement may seem, bears out both expectations.

The similarities will first be reviewed. Both the high-school and the college courses rely upon textbooks. This is shown by the results of a computation of the percents which these are of the total reading requirements of the courses, by the infrequency with which portions of the textbooks are omitted, and moreover, by the fact that most of the collateral readings are in volumes intended for use as texts. There is considerable similarity in the collateral reading assigned in connection with the high-school and college courses. But the most significant similarity of all is to be found in the proportionate emphasis upon the several divisions of the subject. Both the college and the high school endeavor to make contact with all major aspects of the field. Variation in the amount of material covered shows that some high schools do as much as, or even more than, some colleges. Lastly, in respect to economics courses classroom procedure does not differ widely in the two units of the school system.

On the other hand, high-school and college courses seldom use identical textbooks. Again, although *proportionate* distributions to the several divisions are roughly equivalent, the *amounts* of material in each division and for the entire course are much greater in the college than in the high school. In consequence, the reading requirements of the courses per clock-hour of instruction are decidedly heavier for courses on the upper level. Doubtless there are also differences in difficulty, differences which are likely to elude the type of analysis here used and which are encouraged by the greater extent of selection of college students and by better subject preparation on the part of the college instructors.

Although the courses on the two levels are far from identical, they have enough in common to warrant concern as to the current practice of ignoring in the higher institution the fact that a student has had the course in the lower school. The degree of identity in the present stage of development of the high-school

course is not sufficient to justify accepting it in lieu of a standard college course in the field. The situation, morever, is such as not to promise soon a partial recognition of the high-school course, as is sometimes done in chemistry, by abbreviating or otherwise modifying the college course for those who have had the work in the lower unit. Nevertheless, no progress is made in the solution of the problem by disparaging the course in the lower unit and encouraging the deplorable repetition by having students take both courses, as is now too often done. If the present tendency to more extended recognition of the social studies in the high school continues, as seems almost certain, this repetition is likely to increase rather than to diminish, unless high-school economics comes to be merged in the composite courses in social science.

Other Considerations to the Same Effect

The findings of extended investigations in five other fields—English literature, English composition, elementary French, algebra, and American history—are for the most part fully as striking in regard to overlapping. The college courses exceed the high-school courses in quantity; but in the nature and distribution of content the two levels of courses overlap extensively.

It is conceded that, although our methods of inquiry were designed to discover qualitative differences between the courses, they have not done so completely. Nothing short of a comprehensive plan of measuring the results of instruction could meet the requirements. Among the factors certain to make for qualitative distinctions, at least as concerns results, are the more highly selected student body of the colleges and the more extended training in subject-matter of college teachers. There are also other qualitative differences in detail of content which are not discoverable by the methods used.

But, after all admissions of undiscovered distinctions have been made, the large degree of identity of content remains as the salient feature. This conclusion is supported by other facts than those we have just summarized. Much of the present high-school subject-matter is a heritage from collegiate curricula.

Subject after subject has been depressed, usually without dilution, from college to high school. Since this depression has been accomplished by teachers trained in the colleges, it would be surprising indeed if they had not transferred to the lower school, without much change, the work taken by them in college.

Our major conclusion is also supported by the proximity of classification of students taking these high-school and college courses and by the degree of similarity in the teaching methods. For example, the portion of the high-school course in English which is devoted to the survey of English literature is taken typically by Seniors, while the college course is usually taken by Freshmen and Sophomores. The tendency to nearness of classification is characteristic of most of the courses scrutinized. The first college courses in most of these subjects are typically pursued either in the year immediately following that in which the corresponding course is pursued in high school, or with but a single intervening school year. Much less frequently is there a longer interval of time between them. Under such circumstances it is not to be expected that the courses will differ widely.

As to similarity of methods, the chief difference here seems to be the more frequent use of the lecture method in the college courses, more especially in the survey course in English literature, in chemistry, and in American history. Even in these cases there is not as large a difference as traditional beliefs lead us to expect, the recitation method being the typically predominant one in the college as well as in the high-school courses.

A Study of College Catalogues

In spite of all this repetition in high-school and college courses, little is being done to obviate it. This may be inferred from the following summary of practices in a large number of colleges and universities.

1. Only a single college catalogue among eighty-six selected at random gives evidence of attempting to avoid repetition in English. This college announces that it is possible for a student to be excused from freshman rhetoric by passing an examination at the opening of the school year.

2. The standardization of course sequences in older subjects like the ancient languages and mathematics seems to satisfy the colleges on the score of overlapping. No special adjustments appear in these fields, despite the practical certainty of a large amount of duplication.

3. In approximately 90 percent of the colleges two units of high-school modern language are counted as the equivalent of a year of college work, the student with the former amount to his credit being admitted to second-year college courses in the same language.

4. Chemistry is the only one of the college sciences in which there is any recognition of overlapping. In all others there is seldom, if ever, administrative acknowledgment, other than giving entrance credit, that the student has had a high-school course in an identical line. Even in chemistry only twenty-four, or less than 30 percent, of a total of eighty-six colleges make such acknowledgment. Of these, thirteen reduce the number of semester-hours (by an average of 4.4) required for the completion of the college course in general inorganic chemistry. Among these are five colleges which save the student as much as one year and three which save him a half year in entering advanced courses. The principal remaining form of recognition is simply listing a separate course in general inorganic chemistry for students who offer a high-school unit in this subject. The total number of credits for this course is the same as that for the regular beginning course, yet the student who passes it is no further up the sequence in the department than the student who passes the course for those entering without high-school chemistry. There were nine such institutions represented in the group of catalogues examined.

5. In all the social subjects students who have had no high-school course in a particular field enter the same courses as do those who present half or whole units of admission in the same field.

There is, thus, an *all too common disregard in the college of what the student has compassed in his period of high-school training.*

The Remedy

No early improvement in this condition is likely to take place, because the work duplicated is given in two separate institutions the upper of which is unaware, and is making little or no effort to become aware, of what is going forward in the lower. To some it may seem likely that vigorous efforts at cooperation between educational workers on the two levels will obviate this wasteful repetition and achieve a new and sensible sequence in course materials. Doubtless, some progress would result from such cooperation; and there should certainly be no delay in bringing it about. But it is easy to be over optimistic on this score. The present duplication has existed over a long period and has been accentuated rather than diminished with the lapse of time.

The facts presented and the conclusions drawn all point in a single direction. They point to the public junior college as the institution which will bring the first two college years into a coherent plan of secondary education. What is required is an organization that will bring the courses on the two levels, as well as the teachers who give these courses, into close and frequent contact. Only in this way can we have any assurance of achieving such a re-alignment of courses in each field as will promise to students the maximum of progress and training. For instance, after junior-college reorganization has brought different levels of work into close association it is unlikely that we shall go on having, as is now too frequently the case, two courses in American history, one in the twelfth grade and the other in the fourteenth or fifteenth, both attempting to exhaust the possibilities of the outstanding movements from the period of discovery to the present day. The same may be said of high-school and first college courses in other fields. The re-alignment should and will bring profound modifications of content and a standardization which is not now possible. Only through junior-college reorganization of the type indicated shall we eliminate superfluous repetition in the college of work already covered in the high school. Only in this way will the time soon come when

educational advice to the student will assist in securing the proper distribution of his work during the full period of secondary education. With the present tendency to think of these two levels as distinct periods of education—a theory which is badly shattered by a close inquiry into the conditions—there is little likelihood of achieving a satisfactory distribution.

THE SUPERVISION OF TEACHING IN GEOGRAPHY[1]

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How shall we proceed to plan an intelligent supervision technique in geography? It is easy to state the answer to this troublesome question, but very difficult to make our answer function. In order to supervise any subject well we must observe the principles of supervision, and we must know something concerning the subject-matter. In this paper it is assumed that the following principles of supervision are valid. Then supervision should (1) help the teacher to meet the difficulties; (2) help her to place major emphasis on that which is most important and minor emphasis on that which is less important; (3) encourage and stimulate her by continually pointing out the value of the subject-matter to life values in general; (4) suit the character of the subject-matter to the needs and capacities of the children.

These principles are easy to state but they are difficult to execute so far as geography is concerned. What are the difficulties in the learning and teaching of geography? What are the major and minor elements of the subject? Just what shall we expect of geography as contributing to the general values of life? How should the subject be graded?

The purpose of the investigation to be described here was to attempt to obtain a more definite and intelligent answer to some of these questions. The method used was that of a survey of what teachers and supervisors expect pupils to know about geography as evidenced by the questions they ask. Three hundred and sixty-eight test and examination papers were studied. The papers included those used in thirty-nine eighth-grade diploma examinations and those used in grades four to seven in thirty-seven village and twenty city systems.

[1] Read before the Educational Research Association at Cincinnati, February 25, 1925.

The study soon showed that the most pressing difficulty in supervision arises from a failure to observe the second principle mentioned above. Teachers and supervisors are unable to distinguish that which is of major importance from that which is trivial. The 368 examiners asked questions as shown in Table I.

An inspection of Table I raises some interesting questions. Should we expect our pupils to know the whereabouts of 1,250 things in geography? Should we require them to learn the names

TABLE I. CLASSIFICATION OF QUESTIONS

	Total Number of Different Items	Total Frequencies
1. "Where"	1,250	3,937
2. "Name"	1,380	3,089
3. "What and where"	687	1,778
4. "Why"	81	889
5. "Define"	278	612
6. "Compare"	213	279
7. Map drawing	46	184
8. "What is it for"	80	131
9. "How"	149	165
10. "Discuss"	230	295
11. Effect—cause	51	108
12. "Describe"	95	157
13. Boundary	24	41
14. Trade-route	77	90
15. Miscellaneous	663	855
Total	5,304	12,608

of 1,380 elements? Are 81 "why" questions too few, too many, or just enough? Questions such as these may well be asked with reference to each of the fifteen types.

From the standpoint of relative values still other questions arise. If 1,380 distinct "name" questions are too many which ones shall we omit? Even if we knew definitely which ones to omit we should still have to decide which elements to present first and which next.

Some light is thrown upon these questions by dividing the elements into two groups on the basis of frequency of occurrence. In Table II the questions which appear five or more times

are classified. The reading is, There were 219 "where" questions which were asked five or more times, etc.

These 603 questions were repeated often enough to make a total frequency of 6,502. From Table I we find that the grand total frequency of the 5,304 questions was 12,608. In other words, out of 5,304 separate questions asked 603 were repeated often enough to constitute more than one-half of the whole amount of subject-matter required.

Even in the case of the 603 questions there is much disagreement. No one question was repeated more than 46 times by the 368 examiners. This brings us at once to the heart of the diffi-

TABLE II. SUMMARY OF QUESTIONS ASKED FOR FIVE OR MORE TIMES

1.	"Where"	219	9.	"How"	9
2.	"Name"	168	10.	"Discuss"	11
3.	"What and where"	101			
4.	"Why"	24	11.	Effect—Cause	5
5.	"Define"	28	12.	"Describe"	4
			13.	Boundary	2
6.	"Compare"	14	14.	Trade-route	none
7.	Map drawing	7	15.	Miscellaneous	2
8.	"What for"	9		Total	603

culty of supervision in geography. We, as teachers and supervisors, have not yet been able to agree upon what geography is. Under present conditions what we call geography is in reality a hodgepodge of essentials and non-essentials. Intelligent supervision is impossible until this tangle is unravelled.

What Can We Do about It?

It would be fine if we could lie back upon our oars and wait until the curriculum experts tell us what to do. Unfortunately, however, they are still in disagreement. Meanwhile teachers are expected to teach geography to thousands of pupils every year and we as supervisors are expected to help them do it. We cannot afford to lie back upon our oars. We must do something. Under these circumstances the 603 questions of Table II offer the best hope. Let us be sure to teach all of them well and as

many more as there is time for. Let us also improve the 603 as best we can and wait patiently until the curriculum experts have something better to offer.

In Wisconsin the 603 questions have been published in mimeographed form. They are contained in what is known as the "Second Preliminary Report on Examination Questions in Geography." It is impossible to give them all here but I submit the section which relates to "where" questions in Table III.

TABLE III. TYPE I. "WHERE" QUESTIONS

	Frequency	Range		Frequency	Range
AFRICA					
Congo	6		Bordeaux	10	
Cape Town	9		Baltic Sea	12	
Cairo	17		Berlin	20	
Madagascar	5		Belfast	5	
Nile River	13		Brussels	11	
Sahara Desert	6				
			Coal Regions	5	all
ASIA			Cities	9	5-10
Asia	5		Constantinople	15	
Armenia	5		Copenhagen	7	
Bombay	10		Countries preferable for living	7	1-all
Calcutta	12				
Everest Mt	10		Christiania	6	
			Carpathian Mts	6	
Ganges River	6		Geneva	7	
Hong Kong	5		Greenwich	5	
Himalaya Mts	11		Glasgow	8	
Jerusalem	6				
Manila	21		Hammerfest	6	
			Hamburg	6	
Mountains	6		The Hague	8	
Peking	19		Iron Regions	5	all
Philippine Is.	11				
Persia	6		Liverpool	19	
Tokio	17		London	30	
Yokohama	5		Madrid	11	
			Mountains	11	2-all
AUSTRALIA			Moscow	9	
Melbourne	5				
Sydney	5		North Sea	6	
			Naples	5	
EUROPE			Odessa	9	
Apennines	8		Paris	29	
Alsace-Lorraine	8		Po River	7	
Alps Mts	19				
Amsterdam	9				
Adriatic Sea	5		Petrograd	14	

	Frequency	Range
Pyrennees Mts.	11	
Rivers	12	5-all
Rhine River	20	
Rome	14	
Rhone River	7	
Ruhr Basin	7	
Seine River	8	
Stockholm	6	
Thames River	14	
Ural Mountains	6	
Vienna	6	
Vesuvius	9	
Volga River	8	
NORTH AMERICA		
Appalachian Mts.	7	
Baltimore	15	
Buffalo	13	
Boston	26	
Countries (Local)	7	1
Chicago	23	
Counties	5	1-all
Detroit	17	
Duluth	9	
Denver	10	
Erie Canal	7	
Everglades	8	
Great Lakes	13	all
Great Salt Lake	8	
Great Basin	5	
Galveston	11	
Greenland	5	
Grand Canyon	7	
Havana	9	
Hudson River	8	
Key West	7	
Kansas City	5	
Los Angeles	7	
Mississippi River	14	
Missouri River	5	
Milwaukee	24	
Montreal	7	
Mountains	16	1-all
Minneapolis	9	
Mammoth Cave	5	
New Orleans	29	
New York City	23	
North America	6	
Niagara Falls	5	
Ohio River	7	
Ozark Mountains	6	
Panama Canal	8	
Pittsburgh	19	
Porto Rico	7	
Panama	11	
Philadelphia	15	
Portland, Oregon	6	
Quebec	5	
Rocky Mountains	5	1-all
Rio Grande	9	
Rivers	12	3-all
St. Lawrence River	11	
Sierra Nevada Mts.	5	
Salt Lake City	5	
San Francisco	25	
Seattle	8	
State (Local)	6	
St. Louis	10	
UNITED STATES		
Coal Regions	20	1-all
Cotton Regions	18	1-all
Corn Regions	11	1-all
Orange Regions	5	1-all
Sugar Cane States	12	1-all
Sugar Beet States	5	1-all
Tobacco States	7	1-all
Forest Areas	5	1-all
Cities	14	2-10
Gold Regions	5	all
Wheat Regions	10	1-all
Rivers	7	2-all
Mountains	9	2-all
Exports (where to)	6	4-all
Island Possessions	6	3-all
Lumber Regions	12	1-all
Dairying Regions	11	1-all
Agricultural Regions	6	1-all
Capital	9	
Iron and Steel Centers	14	1-all
Heaviest Rainfall	6	1-all
Imports (whence)	11	3-10
Arid Lands	5	1-all
Winnipeg	9	
Wisconsin	8	

	Frequency	Range
Washington, D. C.	14	
Yukon River	14	
Yellow Stone National Park	17	
SOUTH AMERICA		
Andes Mountains	9	
Amazon River	14	
Buenos Aires	20	
Cities	11	
La Plata River	5	
Mountains	10	
Nitrate Regions	5	
Orinoco River	11	
Para	14	
Pampas	6	
Punta Arenas	5	
Rio de Janiero	16	
Rivers	10	
Rubber Regions	6	
GENERAL		
Cotton Regions	18	1-all
Coal Countries	14	1-all
Corn Regions	11	1-all
Coffee Countries	16	1-all
Copper Countries	5	1-all
Cattle Countries	5	1-all
Continent (Local)	6	
Capricorn, Tropic of	5	
Dardanelles	6	
Diamond Centers	8	1-all
Dairying Regions	7	1-all
Deserts	6	1-all
Gibraltar	23	
Gold Regions	8	1-all
Hawaii	11	
Honolulu	12	
Irrigation	7	
Iron Regions	12	1-all
Lumber Centers	10	1-all
Mediterranean Sea	8	
Nitrate Regions	5	1-all
Orange Countries	8	1-all
Rubber Centers	13	1-all
Rice Regions	12	1-all
Salt Lakes	5	2-all
Suez Canal	18	
Silk Centers	12	1-all
Sugar Centers	11	1-all
Salmon Centers	5	1-all
Tea Regions	10	1-all
Wheat Regions	16	1-all
Wool Regions	6	1-all
Zones	12	all
WISCONSIN		
Fox River	7	
Madison	9	
Cities (Local)	19	1-all
Railroads (Local)	10	1-all
Rivers (Local)	8	1-all
Superior	10	
Townships (Local)	12	1-all
Cities	45	1-all
Rivers	38	1-all
Railroads	17	1-all
Products	7	5-all
Industrial Sections	9	3-all
Lumber Sections	9	1-all
Dairying Sections	10	1-all
Potato Sections	10	1-all
Iron Regions	6	1-all
Lake Winnebago	5	
Capital	7	
Lakes	9	1-all

Total single items List A	219
Total single items List B[2]	1,031
Total	1,250
Total frequency List A	2,283
Total frequency List B	1,654
Total "Where" Questions	3,937

[2] Namely, the list of questions occurring less than five times.

The questions read—Where is the Congo? Where is Cape Town? etc. *Frequency* in Table III shows how often each element was asked for. The range column shows how many are required. Thus under Europe we have such questions as locate five cities, locate ten cities, etc.[3]

Summary

Intelligent supervision of geography is impossible until there is a better agreement upon minimum essentials. In the absence of anything better it is recommended that the 603 elements which recur five times or more in 368 sets of examination and test questions be considered as minimum essentials.

[3] The complete list may be obtained in mimeographed form from Edwards Bros., Ann Arbor, Michigan.

THE VOCABULARY OF HIGH-SCHOOL PUPILS IN WRITTEN COMPOSITION[1]

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In a cooperative study of English in grades VII to XII which was recently made in some of the smaller city school systems of Kansas written composition was one of the subjects tested.[2] About 75 percent of the compositions considered in this study were written on the subject, "How I Would Most Enjoy Spending Next Christmas Vacation." The remaining compositions were entitled "What I Would Like to Do Next Saturday to Have a Good Time." About ten percent of the pupils were allowed to choose between these two subjects. A strong preference was shown, however, for the former. The pupils were instructed to assume that the money and permission needed for their plans would be provided. Their task was to present a well-written composition which would be interesting to the reader. Twenty-five minutes were allowed for writing the compositions, although but few pupils seemed to require the full time.

In January the median composition scores in grades VII, VIII, and IX on the Nassau-Hillegas Scale, were about one year below the Trabue standards for the end of the year, that is, they lacked approximately a half-year of reaching standard achievement in the subject. In grades X, XI, and XII, the composition scores were less satisfactory. They were all between one and two years below the Trabue standards for those grades.

One was impressed when reading these compositions by the general lack of clear, easy, or forceful expression and by the prevailing dearth of vocabulary. Emphasis, precision, emotional

[1] Read before the Educational Research Association, February 25, 1925.

[2] The study was directed by the writer who provided full instructions for the schools which participated. The tests were administered by the regular teachers. The test papers, usually after they had been scored, were sent to the School Service and Research Bureau of the State University where results were carefully re-checked and composite tabulations made.

coloring, and style all suffered from the attempt to communicate thought without an adequate command of the verbal instruments needed. Vocabulary tests were given to these pupils, and the subsequent conclusion reached was that the mere recognition of words gives no definite assurance that they will function in written work.

A detailed analysis of the vocabulary actually used by these pupils in their compositions proved more significant. The Thorndike word list[3] was used as a basis of comparison in this study. Although it deals with word knowledge, or what may be called the reading vocabulary of pupils in the elementary school, still it was the best instrument at hand to use in measuring the vocabularies of these junior and senior high-school pupils.

TABLE I. DISTRIBUTION BY GRADES OF THE PUPILS WRITING THE COMPOSITIONS

Grades	Group I	Group II
VII	184	89
VIII	214	86
IX	489	140
X	426	159
XI	343	114
XII	204	94
Total	1,860	682

The number of compositions written in this study and their distribution by grades are shown in Table I. The total number was 2,542, but after a random sampling of the papers sent in by two of the larger schools the number of compositions actually analyzed was 1,812. Five of the schools had a high-school enrollment (IX to XII inclusive) of from 160 to 600 pupils. These were designated as Group I. Group II included nine high schools

[3] The development of this list was reported by Dr. E. L. Thorndike in the *Teachers' College Record* 22:334-70, September, 1921. It consists of 10,000 words listed in ten divisions of 1,000 words each according to the frequency of their occurrence in children's literature, elementary-school textbooks—including history, geography, reading, and arithmetic—newspapers, correspondence, a Biblical concordance, and vocabularies of elementary French, German, and Spanish books.

which had enrollments varying from 50 to 150. Some of the schools in this group were represented only by high-school classes, while others included the seventh and eighth grades only.

The grades usually comprising the junior high school are represented by 1,202 pupils, although only two of these small school systems maintained a definitely organized junior high school. The other schools represented the 8-4 plan of organization. The schools included in this study represent a wide geographic distribution throughout the State and a chance selection from among the schools which participated in the cooperative testing program.

All the words in these compositions were classified to correspond with the successive "thousands" of the Thorndike list.

TABLE II. MEDIAN PERCENTS OF COMPOSITION WORDS WHICH ARE IN THE FIRST THOUSAND OF THE THORNDIKE LIST

Grades	Group I	Group II
VII	91.2	90
VIII	91	90
IX	89	90
X	88	90
XI	87.7	89
XII	87.5	88

The percent of words used by the pupils of each grade which were also found in the first thousand words of the Thorndike list is shown in Table II.

The first thousand words are the most usual and hence the most familiar words found in the Thorndike analysis of elementary-school reading sources. A few of the words included in the first thousand will serve to illustrate their type to those who may be unfamiliar with the list: *bread, door, animal, cold, discover, and, house, money, pleasant, snow, road, weather, sleep, go, their.* Such words hardly constitute an index of actual breadth or wealth of vocabulary on the part of high-school pupils.

A glance at Table II discloses the fact that in the smaller schools of Group II the pupils showed no increase in range or extent of their writing vocabulary during the first three years

following the seventh grade. One may even wonder whether the small difference in percent due to the slightly less restricted vocabulary of the high-school Juniors and Seniors is not as likely to be the effect of selection resulting from pupil elimination as the effect of school instruction. Even in the larger schools of Group I only from 9 to 12.5 percent of the words used belonged to lists above the first thousand.

When the analysis is continued a step further even the information presented in Table II appears considerably overstated in the pupils' favor. Many of the words used which are listed beyond the first thousand were suggested by circumstance: (1) Two words, *Saturday* and *vacation*, frequently repeated by the pupils in their compositions and not in the first thousand, were

TABLE III. PERCENT OF COMPOSITION WORDS ABOVE THE FIRST THOUSAND WHICH CAME FROM ACCIDENTAL SOURCES

Grades	Group I	Group II
VII	34	28
VIII	39	25
IX	32	30
X	33.5	32
XI	33	40
XII	27	36

provided in the titles suggested. (2) Proper nouns and local geographic names indicating destination afforded many other words. (3) Several words were used which are not listed in the first thousand but which have in all probability now become as familiar and as widely used as some which are so listed, for example, *auto, movie, truck, radio, airplane,* and *speed.* (4) Common abbreviations, contractions, and slang terms likewise contributed rather liberally to the group of words which were not found in the first thousand of Thorndike's list.

These sources accounted for all the words listed above the first thousand which were used by many of the pupils. The percent of words, however, classed above the first thousand, which were provided by the accidental sources just indicated, was significantly high. This may be confirmed by reference to Table III.

From 25 to 40 percent of the words which these pupils used beyond the Thorndike first thousand—and the number was disappointingly small—may be considered accidental rather than selected. Obviously then if one should revise the percents in Table II in the light of the facts in Table III he would find that an average of only 5 to 8 in each 100 words freely used by the pupils in their compositions were really above the first thousand in the Thorndike vocabulary ranking.

The median length of the written compositions in the high-school classes was 125 words, while the middle fifty percent lay between 95 and 165. In grades VII and VIII the median length of composition was 107 words for Group I (the larger schools)

TABLE IV. TOTAL FREQUENCY OF USE OF ABSTRACT WORDS OR EXPRESSIONS IN THE COMPOSITIONS

Grades	Group I	Group II
VII	0	1
VIII	12	0
IX	6	3
X	16	4
XI	13	3
XII	16	12
Total	63	23

and 99 words for Group II (the smaller schools). The time allowed seemed more than ample for most of the pupils, the titles given seemed to interest them, and they applied themselves to the task in a willing and whole-hearted manner. Yet the compositions were prevailingly stereotyped in style and content with the limitations of vocabulary which have already been pointed out.

Two other phases of the pupil's vocabulary, the use of words or phrases pertaining to abstract qualities or ideas and the use of adjectives to qualify or define ideas, were also given brief consideration. Only those words, more commonly accepted as abstract terms, such as *happiness, pleasure, charity, courage,* were considered. How little use the pupils had for such words, even

in dealing with the activities of the Christmas season, is indicated in Table IV. Since Group I after a random sampling included 1,130 and Group II, 682 compositions, it is evident that, in many of the classes reported here, the use of terms dealing with abstract qualities or ideas was negligible.

It was felt that the extent to which the pupil used well-chosen adjectives would provide a significant index of the precision and clearness of his thinking as well as a gauge of that phase of his vocabulary. The facts disclosed by this analysis are presented in Table V.

This tabulation of adjectives considered only the descriptive and definitive adjectives as those which primarily qualify the

TABLE V. MEDIAN NUMBER OF DESCRIPTIVE AND DEFINITIVE ADJECTIVES USED IN THE WRITTEN COMPOSITIONS

Grades	Group I	Group II
VII	2	1
VIII	3	2
IX	4	4
X	4	4
XI	5	5
XII	6	5
Total	24	21

thought expression. It was found that high-school compositions with a median length of 125 words contained an average (median) of only four or five such adjectives. Again and again this count consisted of the same adjective repeated several times—especially was this true of *good, nice, large, big, old,* and *little.* The repetition of the word *ideal* accounted for three of the four adjectives used by one pupil. *Happy* and *merry* were each repeated by another pupil so as to comprise eleven out of the twelve adjectives used by her. *Large* was repeated as often as five times and *nice,* three times in a composition having no other adjectives. These compositions were written by high-school pupils.

The general opinion is that a dinner of thick, tender, juicy, broiled steak, with large, mealy, baked potatoes and rich, brown

gravy promises to be far more appetizing than a meal which consists merely of steak, potatoes, and gravy. Why then do these high-school pupils not show more evidence of recognizing such distinctions? Does this dearth of vocabulary and this poverty in the use of adjectives signify that they lack the kind of ideas which demand more precise, definite, or varied use of language? If so, to whom does the responsibility belong? In the light of this situation what must one conclude about the teaching of English in these schools? If the training in English lacks functioning values what values does it have? A clue to one answer relative to some of these questions is provided by the defensive remark of one teacher of English who said that she was not doing much with composition because the State course of study did not prescribe it.

SOME NEGLECTED PROBLEMS IN CLASSIFYING HIGH-SCHOOL PUPILS

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As long as only a few pupils entered the high school, a narrow curriculum seemed adequate. The occasional pupil who did not desire and could not appreciate what was offered was no great burden upon the consciences of those in charge of the schools.

But along with the ideal of the high school as part of the common school for "all the children of all the people," has come the feeling that the responsibility for holding these pupils in school rests squarely upon the school itself. A high-school principal is entrusted with the preparation for citizenship of 300 first-year pupils. He must give an account of his stewardship. A graduating class of from 30 to 60 pupils no longer satisfies public demands. A class of less than 150 is unsatisfactory and demands an accounting concerning the pupils who have left.

An honest investigation into the causes of failure and elimination in any high school must result in a guidance program designed to prevent such conditions. Any guidance program worthy of the name must be built upon measurements of individual ability and achievement, not upon personal opinion. Measurements in turn lead to a classification of pupils for the purpose of group guidance and to the timely discovery of individual problems so that educational adjustments may be made before it is too late.

With the large increase in the proportion of pupils entering high school, there must necessarily be a lower average and a greater diversity of individual ability. Along with bright pupils there are of necessity a large number of pupils of average and relatively inferior ability who cannot hope to succeed in the older high-school curriculum if the former standards are maintained. These pupils have a moral and legal right to continue their

school work. The permanent success of democratic government requires a type of education for the ordinary citizen which cannot be given to him at a very early age in the elementary schools and then reserved for use until he becomes of voting age.

In accordance with this idea, a campaign has been carried on in Providence for the past four years—a campaign designed to impress elementary-school pupils and their parents with the advantages of the high-school courses. The percent of elementary-school graduates who enter high school has increased from 65 to approximately 90 during this period. Accordingly, in order to justify the increased expenditure of school money, we now find ourselves facing the problem of providing for these pupils the kinds of training which will prove worth while to them personally and which will actually prepare them more adequately for the duties of citizenship.

The solution of the problem, according to Superintendent I. O. Winslow in his annual report, involves these baffling perplexities:

> It is very difficult to determine with any degree of certainty what kind of educational training will be most valuable for each pupil, both for his own individual advantage and from the standpoint of society at large. Intelligence tests have become largely helpful, but not wholly reliable. Other considerations must be taken into account. Although the composite basis of our decision will still leave some small percent of uncertainty, it must produce vastly better results than a do-nothing policy. While pupils of high mentality and good general scholarship may still be permitted to choose for themselves, it is absurd, from the standpoint of waste in public expenditure, or from considerations of actual individual benefit, to permit boys and girls to spend the best years of their youth nominally pursuing courses of high-school work in which they are destined to either total or partial failure.
>
> To persuade both pupils and their parents to accept the decisions of the school authorities in regard to the courses of study that should be pursued is often difficult. The father who is a graduate of a particular high school may be determined to have his son attend the same school, either on account of school loyalty or on the ground that what was good for the father is good enough for the son. Most parents are slow to admit inferior ability in their children. If we must legally permit the people to choose for themselves among the various public high schools, in a general sense, it certainly must be legal to require from candidates for admission to any school or course the qualifications that are requisite

for success in that course; and admission on trial must involve the possibility of denial when the trial proves a failure.

Another obstacle to success in the undertaking to discriminate among pupils and to provide differentiated courses according to taste and ability, is the lack of teachers who have the necessary attitude and training. High-school teachers are customarily regarded as teachers of particular subjects. They are specialists in mathematics or science or history or English. They exercise leadership by giving instruction in the subjects, and pupils who cannot follow drop out by the way. There is need of a greater number of teachers who are specialists in young human nature and who are able to lay aside the interests of the subject itself and endeavor to give large numbers of boys and girls of high-school age the particular training of which they appear to be in greatest need. The selection and training of such teachers is one of the outstanding educational problems of the future.

The step most frequently taken to meet the problem of dealing with the increasing number of high-school pupils is the classification of entering pupils according to intelligence. In relatively few places, however, has such a classification been followed up by a carefully planned program of educational guidance which, as time goes on, can become more and more vocational in its nature. The possibilities of such a guidance program are almost unlimited, but the paths have not yet been blazed and the principles have not been sufficiently developed to offer a safe and sure foundation. A treatment of such principles as appear promising must be reserved for another occasion. Meanwhile it is the purpose of this paper merely to point out some of the pitfalls of an intelligence classification.

The accompanying chart indicates the distribution of children of the June, 1923, graduating class from the elementary school according to chronological age, mental age, and intelligence quotient. All three of these considerations must be taken into account in their classification as well as their scholarship record and their probable educational objectives.

This chart should be read as follows: Of the pupils twelve years old, 9 had a mental age of twelve, 16 a mental age of thirteen, 24 a mental age of fourteen, etc. Or reading in the vertical column, of the pupils who had a mental age of eleven, 2 had a chronological age of thirteen, 25 of fourteen, 18 of

fifteen, etc. Or reading between the diagonal lines representing intelligence quotients, of the pupils whose intelligence quotients were between 100 and 110, 9 had a chronological and mental age of twelve, 128 had a chronological and mental age of thirteen, etc.

If these pupils were classified by chronological age, the range of mental ages among the thirteen-year-old pupils, for instance,

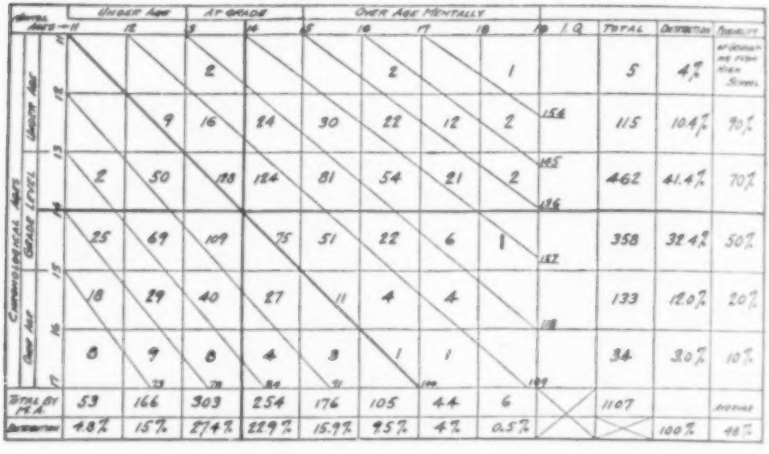

FIGURE 1. A CHART SHOWING THE DISTRIBUTION OF PUPILS ACCORDING TO CHRONOLOGICAL AGE, MENTAL AGE, INTELLIGENCE QUOTIENT, AND THE CHRONOLOGICAL- AND MENTAL-AGE LEVELS

would be from eleven to eighteen. If the pupils were classified according to mental age, among the pupils whose mental ages were thirteen, we should find chronological ages ranging from eleven to sixteen. If the pupils were classified according to intelligence quotients, we should find among the pupils whose intelligence quotients were 100, both chronological ages and mental ages ranging from twelve to sixteen.

This clearly shows that all of these factors—and there are many others as well—should be taken into consideration in any classification of pupils that claims to be scientific. The over-ageness or under-ageness chronologically and mentally both for

the grade (indicated by the heavy line at 14) and for the section of the class in which each pupil is placed is important.

In a school where pupils have been classified by psychological scores or mental ages, there are almost as many individual problems as with no classification at all. This can readily be seen by noting the variation in intelligence quotients among pupils of the same mental age. Although two pupils may have the same mental age their intelligence quotients or "rates of learning" may vary over forty points. The result might be likened to a race between a thoroughbred and an ordinary saddle horse. Although at a particular time in the race they may be neck and neck, they are travelling at quite different rates, and so their equality is but momentary. Moreover, if pupils are classified by mental age, the resulting wide variation in chronological ages, especially during adolescence, is undesirable and may result in a lack of adjustment quite as serious as a like variation in mental age.

A glance at the last column of the chart indicates another difference which is important from the point of view of guidance. An educational program should take into account the probable educational future of each child. A direct relationship exists between chronological age, over-ageness or under-ageness for the grade, and the probable length of time during which the pupil will remain in school. A study of any age-grade table will illustrate this tendency. This item should certainly be taken into account in the classification of high-school pupils.

In other words, the purpose of the classification of high-school pupils should be not only for efficiency of instruction, but also and principally for the more effective guidance of pupils in their choice of courses and selection of electives. This is a far more complex and important problem than that of efficient instruction since the real value of any instruction depends upon the probability of its use. However efficiently algebra is taught, the effort may be wasted if the subject is never applied in the life of the pupil. Some one should decide who should and who should not elect the various subjects offered in the secondary-school curriculum.

Some of the reasons for the dissatisfaction with various experiments in the classification of pupils according to intelligence are made evident by a study of the foregoing chart. Other important reasons are to be sought elsewhere. We must, for example, understand the conditions under which the individual is learning; and one of these conditions is the quality of the competition which he is meeting from other members of the class. The following facts should be ascertained and studied: Is the pupil above or below the average chronological age of his grade and class? Is he above or below the average mental age of his grade and class? If his mental age is equal to the average of his grade and class; is his intelligence quotient, or rate of learning, above or below the average of his grade and class?

Many teachers who are attempting to work with classified sections do not seem to realize that pupils having the same intelligence quotient are equal only potentially, not actually. They will have the same mental age only if they are equal in chronological age. Unless this is thoroughly understood many costly mistakes will be made.

Recently a high-school principal called my attention to two boys in the same class with the same intelligence quotient (about 100).

One, "A," was doing excellent work, and the other, "B," was in danger of failing. Both were taking the classical course. Here was apparently a failure of the intelligence-quotient classification, since both of the boys seemed to be trying equally hard. An investigation showed that the average chronological age of the class was thirteen and a half, the average mental age fifteen and a half, and the average intelligence quotient, 115. "A" was sixteen in both mental and chronological ages. Consequently, although his intelligence quotient was lower than the average, his mental age was half a year and his chronological age two and a half years above the average for his class. Greater physical maturity and superior character qualities, as well as his pride had made it possible for him to excel. "B," however, was only twelve years of age both mentally and chronologically. Although his intelligence quotient was also 100, he was one and a half

years chronologically and three and a half years mentally under the average age of his class. He had entered the elementary school a year earlier than most pupils, and he had gained a year through home tutoring and attendance at a summer school. His superior home environment had enabled him to keep up with his grade until he encountered the keener competition of the high school.

A somewhat different case of maladjustment was that of a boy whose intelligence quotient was 135. His parents knew him to be very bright; and his marks had always been high. Yet he was doing only passing work in his new grade. The teacher was blamed by the parents, but the principal knew her to be capable, faithful, and reliable. The boy had been taught at home by his mother, who was a former teacher, until he was six years old. He had then been entered by the primary supervisor in the IV-B grade against the advice of the principal. He was poor in penmanship but good in reading and quick at arithmetic. At the age of eight, when he was in the VI-B grade, the boy became a problem. His mother was much displeased with his marks, and they were not improved by her remonstrances or by home study.

An intelligence test showed a mental age of eleven and a half years, or half a year above the average of the VI-B grade as a whole. The average mental age of his class, however, was twelve and a half years, or a full year beyond his age. Moreover the boy was three years under age chronologically for both his class and grade. The average intelligence quotient of the class was 121, for it was a selected group in a select community. In fact, there were only three pupils in the class who were younger mentally than this boy, and six actually had as high intelligence quotients as he, and were older than he by three or four years both mentally and chronologically. Unless the teacher were to mark all of her pupils A or B in every study, this boy would invariably rank C or D, provided each pupil were making the same effort. In the Stanford Achievement Test the boy was above his grade level in every subject, yet he was below his class level. Whether a horse, or a man, or a child is among the leaders in a

contest or a project will depend as much upon the abilities of those with whom he is competing as upon his own ability and effort.

A classification of pupils according to intelligence in the junior high schools as well as in the senior high schools should be more than a mere administrative device to increase the efficiency of instruction. It should be a means by which problems can be isolated, studied, and solved—at first tentatively, but as time goes on with greater accuracy and assurance. A guidance program in these schools, which makes use of individual psychological and educational measurements for purposes of individual guidance as well as for efficient instruction—such a program will prove an important step toward the solution of many of our most difficult educational problems.

NOTES ON THE TEACHING OF ELEMENTARY MATHEMATICS IN COLONIAL AMERICA

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The pioneer work on the history of elementary mathematics in the United States was written by Cajori in 1890.[1] For thirty-five years it has been the only comprehensive treatment of the subject. Since the date of its publication, nothing has been added to our knowledge of the mathematical instruction beyond arithmetic that was given in the schools of colonial America.[2] Smith's *History of Mathematics* contains nothing on colonial mathematics.[3] Stamper, in his work on the teaching of geometry, cites Cajori.[4]

Cajori's treatise begins with a section entitled "Colonial Times." In this he discusses the mathematics offered in the "Elementary Schools," and in the "Colleges." The first two paragraphs will indicate the character of the treatment of mathematics in the elementary and secondary schools of the colonies:

> On the study of mathematics in elementary schools of the American colonies but little can be said. In early colonial days schools did

[1] Cajori, Florian. *The Teaching and History of Mathematics in the United States.* Washington, Government Printing Office, 1890. 400 pp. (U. S. Bureau of Education. Circular of Information, 1890, No. 3).

[2] My study was completed before the appearance of L. G. Simons' *Introduction of Algebra into American Schools in the Eighteenth Century.* Washington, Government Printing Office, 1924. 80 pp. (U. S. Bureau of Education. Bulletin, 1924, No. 18).

[3] Smith, D. E. *History of Mathematics.* Boston, Ginn and Company, 1923. Vol. I.

An interesting article by Professor Smith, entitled "A Glimpse at An Early Colonial Algebra" (*School and Society.* 7:8-11, January 5, 1918), describes "a manuscript on algebra by Samuel Langdon . . . . written under the direction of Isaac Greenwood . . . . On the front cover . . . . 'Samuel Langdon's book, July 25, 1739,' and on the reverse of this leaf . . . . 'Algebra by Isaac Greenwood, M. A. Began July 25, 1739.' A colophon reads: 'Finished writing Algebra August 17, 1739. Algebrae Finis.'" This manuscript is also described by Miss Simons.

[4] Stamper, A. W. *A History of the Teaching of Elementary Geometry.* New York, Teachers College, Columbia University, 1906. p. 96, n. 5. (Teachers College, Columbia University Contributions to Education, No. 23). "Unless otherwise stated, Cajori is the authority here referred to."

not exist except in towns and in the more densely settled districts; and even where schools were kept, the study of mathematics was often not pursued at all, or consisted simply in learning to count and to perform the fundamental operations with integral numbers. Thus, in Hampstead, N. H., in 1750, it was voted "to hire a schoolmaster for six months in ye summer season to teach ye children to read and write." Arithmetic had not yet been introduced there. As late as the beginning of this century there were schools in country districts in which arithmetic was not taught at all. Bronson Alcott, the prominent educator, born in Massachusetts in 1799, in describing the schools of his boyhood, says: "Until within a few years no studies have been permitted in the day school but spelling, reading, and writing. Arithmetic was taught by a few instructors one or two evenings in a week. But in spite of the most determined opposition arithmetic is now permitted in the day school." This was in Massachusetts at the beginning of this century.

In secondary schools, "ciphering" was taught during colonial times, which consisted generally in drilling students in the manipulation of integral numbers. He was an exceptional teacher who possessed a fair knowledge of "fractions" and the "rule of three," and if some pupil of rare genius managed to master fractions, or even pass beyond the "rule of three," then he was judged a finished mathematician.

The author then indicates the dates of appearance of the various mathematical subjects in the curricula of four colonial colleges,[5] as follows:

	Harvard	Yale	William and Mary	University of Pennsylvania
Algebra	1726-38[6], or 1786[7]	1742	1724	1758
Geometry			1724	
Alsted	1636	1701		
Euclid	1726-1738[8]	1733		1758
Trigonometry		1766		1758
Conic Sections		1766[9]		1758
Fluxions		1766		1758[10]

[5] The table is mine.

[6] Cajori, Florian. *Op. cit.*, p. 25. "It is probable that with the introduction of Ward's *Mathematics*, algebra began to be studied at Harvard."

[7] *Ibid.*, p. 25. "But I have found no direct evidence to show that algebra actually was in the college curriculum previous to 1786."

[8] *Ibid.*, p. 24. "Sometime between the years 1726 and 1738 . . . . Alsted's old Geometry had given place to . . . . Euclid."

[9] *Ibid.*, p. 32. "This is the earliest distinct mention of conic sections and fluxions as college studies in America."

[10] *Ibid.*, p. 36. "The courses of study mapped out by Dr. Smith," first provost of the College, Academy, and Charitable School of Philadelphia. As a matter of fact, these "courses of study" were first published in the *Penn-*

One gains the impression that mathematics beyond arithmetic appeared only in the colleges during the colonial period. It may be of interest to prospective chroniclers of the development of instruction in mathematics in this country to know that the "higher branches" were also taught in the lower schools of the day.[11] The records indicate that some of these subjects were offered in schools of sub-collegiate grade as early as in the colleges.

Commencement theses on algebraical topics at Yale in 1718 and at Harvard in 1721 are evidence of the study of algebra at those institutions, either in course or as extra-curricular interests. "James Diman's Book, 1730/31" indicates that Diman, who was graduated from Harvard in 1730, may have studied algebra during Greenwood's professorship, 1727-38. If Samuel Langdon studied algebra "under the direction of Isaac Greenwood" between July 25 and August 17, 1739, he did not study it at Harvard, but rather in Greenwood's private school. It is probable that algebra was taught at Harvard between the years 1727-38.

Instruction in algebra was offered in Boston, in 1727. The record follows:

> The Experimental Course of Mechanical Philosophy which was intended to have been recapitulated this Summer, is, by Reason of the Shortness of the Evenings, and the Heat of the Season, deferred till the Fall, when Notice will be given thereof. In the mean time, if any Gentlemen are desirous of being acquainted with the Principles of Algebra; Sir Isaac Newton's incomparable Method of Fluxions, or the Differential Calculus, together with any of the universal Methods of Investigation used by the Moderns; the Elements of Euclid and Appolonius; or any Part of Speculative or Practical Mathematicks, commonly taught in the Colleges, or Schools of Europe: Attendance will be given by the Author of the said Course at Mrs. Belknap's, at the upper

sylvania Gazette of August 12, 1756. The plan was published again in the *American Magazine* (October, 1758. pp. 630ff.), of which Provost Smith was editor. In this latter article, Mr. Smith remarks that "this plan, which was first published in August, 1756," was "subscribed by the Faculty of masters." When the Academy opened, January 7, 1751, algebra and geometry were included in the curriculum.

[11] Algebra, geometry, mensuration, trigonometry, conic sections, and fluxions are often mentioned in the records as the "higher Branches of the Mathematicks." The writer is aware that all mathematics through the calculus is called "elementary," or "introductory."

End of Queen Street, Boston: Where, also to such as are already instructed in the Mathematical Sciences, the Principles of Sir Isaac Newton, and the Modern Discoveries in Astronomy and Philosophy will be explained and demonstrated in a concise and easy Manner.[12]

The "author of said course" was Isaac Greenwood, who graduated from Harvard in 1721 and, in 1727, became Harvard's first Professor of Mathematics. Greenwood held the Hollis professorship until his dismissal in 1738.

Another interesting early curriculum which included algebra was announced in 1730 by James Lyde of New York City:

On the 15th of September next, at the Custom House in this City (where a convenient Room is fitted up) James Lyde designs to Teach in the Evenings (during the Winter) Arithmetick, in all its Parts, Geometry, Trigonometry, Navigation, Surveying, Gauging, Algebra, and sundry other Parts of Mathematical Learning. Whoever inclines to be instructed in any of the said Parts of Mathematical Knowledge, may agree with the said James Lyde at the House of William Bradford in the City of New York.[13]

Algebra appeared also in the curriculum of the public Grammar School in New York City in 1734: "At the said school are Taught all the Branches of the Mathematicks, Geometry, Algebra, Geography, Navigation, Merchants Book-keeping after the most perfect Manner."[14] In the same year Theophilus Grew of Philadelphia taught "algebra . . . . and all other Parts of Mathematicks."[15] A year later he added "the Use of . . . . scales, Sliding Rules, and all sorts of Mathematical Instruments."[16] Grew will be remembered as the first Professor of

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[12] *Boston News Letter.* June 29-July 6, 1727.
Ibid., July 6-13, 1727. Conic sections is added.

[13] *New York Gazette.* August 31-September 7, 1730.
New York Gazette and Weekly Mercury. January 19, 26, 1778. John Davis: "that excellent science Algebra, in its simple, quadratic and adsected equations."

[14] *New York Gazette.* January 7, 14, 21, 28, 1734. Alexander Malcolm was master of the public Grammar School until it was discontinued in 1738.

[15] *American Weekly Mercury.* October 2-10, 17-24, October 31-November 7, December 5-12, 1734.

[16] *Ibid.*, October 16-23, 1735.
Pennsylvania Gazette. September 19, October 10, 1754. William Dawson: "the use of the Gunter's sliding-rule."
Ibid., November 20, December 4, 1760. William Dawson: "all the necessary Branches of the Mathematicks, with the Solution of every Problem, by the plain or sliding Gunter."

Mathematics at the Philadelphia Academy, which later became the University of Pennsylvania. In 1735 John Hunter also of Philadelphia taught "Algebra or any other Parts of the Mathematicks;"[17] and Joseph Kent, M.A., advertised a similar program in Boston.[18]

Geometry was offered early in the lower schools. The earliest newspaper announcement was published in 1709:

> OPPosite to the Mitre Tavern in Fish-street near to Scarlets Wharff, Boston, are taught Writing, Arithmetick in all its parts; And also Geometry, Trigonometry, Plain and Spherical, Surveying, Dialling, Gauging, Navigation, Astronomy; The Projection of the Sphere, and the use of Mathematical Instruments: By Owen Harris.[19]

This program of studies was duplicated by John Green of Boston in the same year.[20] John Walton "late of Yale Colledge" taught geometry in New York City in 1723.[21] It was offered also by Isaac Greenwood (Boston, 1727), James Lyde (New York, 1730), Alexander Malcolm (New York, 1734), Theophilus Grew (Philadelphia, 1735), and Joseph Kent (Boston, 1735), who have already been mentioned as teachers of algebra. Evidently Isaac Greenwood did not use Alsted's text; in his announcement the subject is entitled "Euclid."

The subject of mensuration appears to have been as popular as that of geometry. An early reference occurs in a "Notice" published by Andrew Lamb, "School-Master in Philadelphia," in 1733.[22] Theophilus Grew and John Hunter in the following year included mensuration in their curricula. Joseph Blanchard of New York City in 1747 described his course as "Mensuration

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It is not improbable that eighteenth century American teachers were familiar with the early seventeenth century treatises of Gunter, Oughtred, and Wingate.

[17] *Pennsylvania Gazette.* March 4-11, 1735.

Ibid., September 14, 1774. John Heffernan: "simple and quadratic Algebra."

[18] *Boston Weekly News Letter.* October 9-16, 1735.

[19] *Boston News Letter.* March 14-21, 1709.

[20] *Ibid.*, March 21-28, 1709.

[21] *American Weekly Mercury.* October 17-24, 1723. There were no newspapers in New York in 1723. Walton advertised in a Philadelphia paper.

[22] *Ibid.*, September 6-13, 13-20, 1733; January 1-8, December 12-19, 1734.

of superficies and solids."[23] This was more common than the shorter title, "Mensuration."

"Trigonometry, Plain and Spherical" was taught in 1709 by two Boston masters: Owen Harris and John Green; in 1739 by Isaac Greenwood,[24] and in 1749 by John Leach.[25] Joseph Kent in 1735 announced the subject as "the Doctrine of Triangles, plain and spheric." It occurred also among the courses advertised in 1730 by James Lyde of New York City, and in 1734 by Theophilus Grew of Philadelphia. John Lewis of New York in 1753 informed his students that "what is called a new Method of Navigation is an excellent Method of Trigonometry here particularly applied to Navigation; But is of great Use in all kinds of Measuring and in solving many Arithmetical Questions."[26] Another New York City master in 1764 taught "Trigonometry with its Application to the taking of Heights and Distances . . . . Spherical Trigonometry, with its Application to Great Circle Sailing and Astronomy."[27]

Instruction in conic sections was given in 1727 by Isaac Greenwood of Boston; in 1759 by James and Samuel Giles of New York City;[28] and in 1760 by Robert Kennedy, John Maxfield, and David Kennedy of Philadelphia.[29] Calculus was offered in 1727 by Greenwood; in 1770 "Fluxions" was announced by Robert Patterson of Philadelphia,[30] and in 1772 by Charles Shimmin of Salem, Massachusetts.[31] Obviously the demand for these subjects was not very great.

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[23] *New York Evening Post.* August 3, 1747.

[24] *Boston Gazette.* March 26-April 2, April 2-9, 1739. After leaving the Harvard faculty, Greenwood opened a school "at the Duke of Marlborough's Arms in King-Street, over against the Golden Fleece, where Attendance is given from 9 to 12 A.M. and 3 to 6 P.M."

[25] *Independent Advertiser* (Boston). April 17, 24, May 1, 1749.

[26] *New York Gazette or Weekly Post Boy.* December 24, 1753; January 7, 14, 21, 1754.

[27] *Ibid.*, January 12, February 16, 1764. William Cockburn.

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[28] *New York Gazette or Weekly Post Boy.* April 30, May 14, 21, 28, 1759.

[29] *Pennsylvania Gazette.* September 18, 25, October 2, 1760.

[30] *Pennsylvania Chronicle and Universal Advertiser.* October 22-29, 1770.

[31] *Essex Gazette* (Salem, Mass.). July 14-21, 21-28, July 28-August 4, 1772.

A list of fifty Boston, New York, and Philadelphia masters who taught various "Parts of the Mathematicks," will serve to indicate the popularity of these studies:[32]

1709 Owen Harris, Boston
Geometry, trigonometry

1709 John Green, Boston
Geometry, trigonometry

1723 John Walton, New York
Geometry

1727 Isaac Greenwood, Boston
Algebra, geometry, conic sections, calculus

1730 James Lyde, New York
Algebra, geometry, trigonometry

1733 Andrew Lamb, Philadelphia
Mensuration

1734 Andrew Lamb, Philadelphia
Mensuration

1734 Alexander Malcolm, New York
Algebra, geometry

1734 Theophilus Grew, Philadelphia
Algebra, geometry, trigonometry

1735 Theophilus Grew, Philadelphia
Algebra, geometry, trigonometry, mensuration

1735 Joseph Kent, Boston
Geometry, trigonometry

1735 John Hunter, Philadelphia
Algebra, mensuration

1739 Isaac Greenwood, Boston
Algebra, geometry, trigonometry, calculus

1741 Alexander Buller, Philadelphia
Algebra, "and other parts of the Mathematics"

1742 Theophilus Grew, Philadelphia
Algebra, geometry, trigonometry

1743 Theophilus Grew, Philadelphia
Algebra, geometry, trigonometry

1743 Charles Fortesque, Philadelphia
Mensuration

1743 James Fox, Philadelphia
Geometry, trigonometry

1743 Nathan Prince, Boston
Algebra, geometry, trigonometry

1744 Theophilus Grew, Philadelphia
Algebra, geometry, "other parts of the Mathematics"

1747 Joseph Blanchard, New York
Algebra, geometry, trigonometry, mensuration

1747 George Bingham, New York
Geometry, trigonometry

1747 Henry Moore, New York
Geometry, trigonometry

1747 John Clare, Philadelphia
Algebra, geometry, trigonometry, conic sections

1748 Cornelius Linch, New York
Mensuration

1748 Thomas Craven, Philadelphia
Algebra

1749 John Leach, Boston
Geometry, trigonometry

1749 John Wilson, New York
Algebra, geometry, trigonometry

1751 Unnamed New York master
Algebra, geometry, trigonometry, "Mathematical Instruments"

1751 John N. Hutchins, New York
Geometry, trigonometry, logarithms

1751 Robert Leeth, New York
Algebra, geometry, trigonometry, logarithms

1751 Andrew Lamb, Philadelphia
Geometry, trigonometry, logarithms

[32] To save space, the references are omitted. They may easily be located in the files of Boston, New York, and Philadelphia papers for the proper years. The writer has, in his collection, as many more, for the same period, in Rhode Island, Connecticut, New Jersey, Maryland, Virginia, Georgia, and South Carolina.

A list of almost three hundred "MATHEMATICAL Books, Sold by Samuel Fuller, at the GLOBE in MEATH STREET, 1726" will be found in G. E. Littlefield's *Early Schools and School Books of New England*. Boston, Club of Odd Volumes, 1904. pp. 204-10. Many of these were used in eighteenth century America.

The titles of many texts appear in book-store advertisements in the colonial newspapers.

1752 Thomas Allen, New York
Geometry, trigonometry
1752 John Clare, Philadelphia
Algebra, geometry
1752 John and James Hutchins, New York
Geometry, trigonometry, logarithms
1753 John Lewis, New York
Geometry, trigonometry, mensuration
1754 John Lewis, New York
Geometry, trigonometry, mensuration
1754 William Dawson, Philadelphia
Mensuration, "use of Gunter's rule"
1755 John Searson, New York
Geometry, trigonometry, mensuration
1755 Andrew Lamb, Philadelphia
Trigonometry
1757 William Thorne, Philadelphia
Mensuration
1757 Joseph Stiles and William Ranstead, Philadelphia
Mensuration
1757 Andrew Morton, Philadelphia
Algebra
1758 James and Samuel Giles, New York
Algebra, Geometry
1758 John Vinal, Boston
Algebra
1759 James and Samuel Giles, New York
Algebra, geometry, conic sections, mensuration
1760 R. and D. Kennedy, J. Maxfield, Philadelphia
Algebra, geometry, trigonometry, conic sections
1760 William Oliphant, Philadelphia
Mensuration
1760 William Dawson, Philadelphia
Geometry, trigonometry, plain or sliding Gunter
1761 William Thorne, Philadelphia
Algebra, mensuration
1763 Samuel Giles, New York
Algebra, geometry, trigonometry
1763 John N. Hutchins, New York
Geometry, trigonometry, mensuration
1764 William Thorne, Philadelphia
Trigonometry, mensuration
1764 William Cockburn, New York
Geometry, trigonometry
1764 Samuel Giles, New York
Algebra, trigonometry
1765 James McCarrell, New York
Trigonometry
1765 Thomas Carroll, New York
Algebra, geometry, trigonometry, conic sections, mensuration
1766 Thomas Carroll, New York
Algebra, geometry, trigonometry, conic sections, mensuration
1766 Alexander Power, Philadelphia
Algebra, geometry, trigonometry, conic sections, calculus
1766 John Pope, Boston
Trigonometry, mensuration
1770 Robert Patterson, Philadelphia
Algebra, geometry, calculus
1771 Andrew Porter, Philadelphia
Algebra, geometry, trigonometry, mensuration
1771 Christopher Colles, Philadelphia
Algebra, geometry, trigonometry, conic sections, mensuration
1773 David Ellison, Philadelphia
Algebra, geometry, trigonometry
1774 John Heffernan, Philadelphia
Algebra, geometry, trigonometry, logarithms, calculus
1774 Thomas Byerley, Joseph Day, New York
Geometry, trigonometry, mensuration

It is evident that, in point of time, the lower schools were well abreast of the colleges in the teaching of mathematics. In the colleges mathematics, in most instances, was a pure science; elsewhere the mathematical subjects were studied with reference to practical purposes. Many of the schools listed above gave

instruction in dialling, gauging, fortifications, gunnery, optics, navigation, and surveying; and for such courses, algebra, geometry, logarithms, mensuration, trigonometry, conic sections, and calculus were necessary. These subjects were very popular throughout the eighteenth century, and the widespread demand for instruction in "all Parts of the Mathematicks" is indicated by the large number of schools in which they were offered.

A BIBLIOGRAPHY OF RESEARCH ARTICLES PUBLISHED IN 1924

E. J. ASHBAUGH
Ohio State University

The following bibliography of research articles published during the year 1924 was the basis for the presidential address at the annual dinner of the Educational Research Association at Cincinnati, February 26, 1925. No claim is made that the bibliography is complete, but it is believed to be representative and to include the great majority of articles published in current magazines.

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Editorials

THE PRE-SCHOOL CHILD

Anyone who is reasonably well informed must have been struck by the recent development of interest in the study of young children. A few months ago Baldwin and Stecher wrote *The Psychology of the Pre-School Child*. This book is a record of the physical, mental, and social growth of a group of normal and superior children between the ages of two and six years. As an indication of the trend of thinking *Progressive Education*, the organ of the Progressive Education Association, has just devoted an entire issue to this subject. Numerous articles have appeared in various periodicals. But the high priest of the movement appears to be Professor Gesell of Yale. In addition to many addresses and smaller productions he brought out the *Pre-School Child* in 1923 and followed it this year with *The Mental Growth of the Pre-School Child*—in our opinion a much more valuable book, at least from the research point of view. Indeed, if we were not reluctant to trench upon the rights of Dr. Baldwin who has consented to review for us the latter volume, we should express in some detail our appreciation of Professor Gesell's latest book.

As early as November, 1923, Dr. Woolley reviewing *The Pre-School Child* expressed her disappointment because the author had not included in his earlier book accounts of his original researches with young children. There was, however, reason for this. Dr. Gesell was then writing a book in which he sought to place before a rather wide reading public his conception of the social and educational policies which should prevail with reference to children of pre-school age. Moreover, he intimated that reports of his own investigations would appear in a later book—a promise which with more than the fidelity usual

in such cases he has fulfilled. His later book does precisely what Dr. Woolley had in mind.

One of the things we most welcome is the sanity and scientific respectability which is now characterizing the study of infants and young children. Much sentimentality and no end of twaddle have appeared in the literature of child study. There is now a commendable disposition to get down to brass tacks. Only lately have we seen the end of the pietistic notions which began with Pestalozzi and which among more recent writers were seldom associated with the penetration of that educational reformer. Froebel's mysticism continued for a long time, and still continues in many quarters, to becloud the view. Not a few persons have observed the behavior of children and have written books about their observations. Sometimes adults have tried to remember and record facts about their own babyhood, but to our mind these notes have been so formless and uncritical, have left so much to the insight of the reader, that their value may be seriously questioned.

Now, however, it is the clinical idea which dominates the study of the pre-school child; and the clinical idea is precisely the idea which should control it. For the clinician, you know, is fundamentally concerned with the careful examination and treatment of individuals. Perhaps the most distinguishing characteristic of his work is the fact that he deals in particular cases rather than in masses or groups of cases. He does not avoid—indeed he seeks—the classification of his findings into norms of development. His data thus become effective in mass education, but at this point he either hands the work over to others or if he does it himself steps out of his clinical rôle. He is much like the physician who becomes a medical examiner, the difference being that the clinician is primarily concerned with mental rather than physical facts and functions. This devotion of the clinical psychologist to the individual child peculiarly fits him to be the exponent of the modern investigation of young children.

Another group of psychologists has played its part in this movement. Whatever may be said about the behaviorists by

those who are out of sympathy with them, it must be admitted that much of the present satisfactory attitude toward the study of young children is attributable to the behavioristic conception of psychology. In other words, the study of the pre-school child has been favored by the behaviorists; and the behavioristic interpretation of mental life is precisely the one which seems now to be most fruitful in the study of children prior to the age of six.

We believe heartily that the intensive study of children of this age is wholesome from every point of view. Whether the study has to do with the physical or mental development of children is quite immaterial. Indeed to separate these except in thinking and for purposes of analysis is a mistake.

The pre-school child repays study and the measures which we may adopt with reference to him are of very large consequence. It has been pointed out that one-third of all the deaths that occur during the lifetime of human beings occur prior to the sixth year of life. Again it is said that during the first five years of life there are ten times as many deaths as there are during the next ten years. Malnutrition, infection, liability to accident, nose and throat disorders are especially prevalent among pre-school children. As might be supposed from known correspondence between mind and body the onset of mental disorders is peculiar to children of this period. Indeed it is possible that both from the physical and the mental point of view much that we supposed to be congenital may turn out to be postnatal in its origin. This idea is an attractive one. The environmentalists may find that this keener analysis and deeper penetration into the facts and meaning of child life have greatly strengthened their position in the contest which they have recently been waging with such doubtful fortunes against the hereditarians.

The pre-school child not only runs great risks, but he also develops with enormous rapidity. Again the body-mind relationship holds. In the first six months an infant doubles his weight and does so again in the course of about three years. Structural changes proceed at a corresponding rate. And during these early years the child is learning with almost unbelievable rapidity. We

customarily designate low orders of intelligence as corresponding to the intelligence of young children. We say an idiot has the mentality of a child of less than three years yet with this mentality the child learns to balance himself with such nicety of adjustment, that he is able to move about without falling, to turn, to stop and start, all with the necessary compensatory adjustments. He learns to use his hands, to bring his thumb into opposition to his fingers. He learns to recognize people and to interpret their moods with considerable accuracy. He develops likes and dislikes, he learns to avoid unpleasant situations and to seek those which give satisfaction. He learns a foreign language so well that in all his life he will probably never learn another so completely.

It is a fascinating period—a period fraught with dangers and difficulties, with rapid development, with new adjustments, and with tremendous potentialities. The pre-school age has been called the no-man's land of psychology. It appears now to have been taken over by the front line of advance. We hope that the terrain may be securely held and that it may be organized to the great advantage of the militant hosts which are now invading it.

B. R. B.

Through inadvertency the signature to the editorial on Speed and Accuracy in the April Journal was omitted. It was written by the Editor.

Reviews and Abstracts

OSBURN, WORTH J. *Corrective Arithmetic.* Boston, Massachusetts, Houghton Mifflin Company, 1924. 182 pp.

This book is written for teachers, supervisors, and students of methods of teaching elementary-school arithmetic. It is both competent in substance and effective in organization. The writing of this book gives to Dr. Osburn the right to be considered a valuable contributor to the science of elementary education.

Some books are interesting but deal with things relatively insignificant; some books deal with significant matter but contain many untruths; some are both pertinent and true but are written so that they baffle the average reader. *Corrective Arithmetic* is readable, it deals with pertinent aspects of the teaching of arithmetic, and its pages are conspicuously full of truth and delightfully void of falsehood. This book should be read by poor teachers of arithmetic for it will help them improve. It should be read by excellent teachers of arithmetic for sheer joy.

The book contains data showing many errors which are inveterate in our schools. It then proceeds to show how these errors may be corrected. Further, it explains how the everyday teacher may spot persistent errors made by her pupils and details concrete techniques to make these particular errors disappear.

Corrective Arithmetic contains a well-organized treatment of the building of drill material to use to correct error or, better, to use to prevent a discouraging amount of error by the average pupil. Teachers will show prudence if they construct drill material for class and individual use along the specifications laid down by Dr. Osburn.

A substantial section of the book deals with the fundamental laws of learning as applied to the mastery of arithmetic. An understanding of this section of the book will give the teacher a solid basis of theory upon which to base practice. In the long run particular methods of teaching will be no better than the theory underlying them.

Dr. Osburn has not exhausted the facts which must be known if we would really understand errors, nor has he presented all the useful types of drill which may be used to correct or head off these errors. He has, however, brought to the teacher in one discussion of reasonable length many of the causes and treatments of the typical weaknesses of arithmetical production in the classroom. Only the careless or the conceited can afford to neglect reading *Corrective Arithmetic.*

F. B. KNIGHT

State University of Iowa

AVERILL, LAWRENCE AUGUSTUS. *Elements of Educational Psychology.* New York, Houghton Mifflin Company, 1924. 425 pp.

"It has been the ambition of the writer," Averill says in his foreword, "to present the chief features of his own course in educational psychology for second-year students, ... teachers in training who have had a general introductory course in psychology."

It is praiseworthy that the author tends, in a psychological work, to avoid philosophy in favor of science, to organize student experimentation as well as textbook study, to draw voluminous illustration from common experience, to fill the more abstract terms copiously with very concrete meanings, to emphasize pleasureable accompaniments of the learning process and motivation generally, and to give the whole a certain experimental and quantitative setting. Education is genuinely emphasized as social, as conserving and progressing, as more than merely utilitarian.

Technically, however, the work does not seem wholly sound. The faculty psychology, disowned (316, 350), still lurks hurtfully and often in the language used (11, 270, 285, 329-30, 381). Concerning the psychology of learning through the strengthening of bonds certain statements appear rather loose, either as to form or as to theory (70, 71, 128, 156). The ideo-motor theory is approved (85, 89-90, 185).

In the faith that book-reviewers have as much right to objective methods as have other classes of the population, I selected thirteen samples from Averill's book—samples intended to represent its best quality, its poorest quality, and a number of qualities between. These samples were ranked by nine men, all of whom have at some time studied under Thorndike, two-thirds of whom have taught educational psychology, and about one-half of whom have achieved some degree of eminence in psychology. The ranks were from 1 to 13, 1 being high. These men also indicated which samples seemed good enough to occupy space in an educational psychology.

It would be interesting to show these sample passages, but to do so would exceed the limits of a review of this kind. In summary, however, it may be noted that the samples ranged from one which all of the nine judges would include to one which only a single judge would include. Only three of the thirteen samples would be included by as many as seven judges, while but six would be included by more than half the judges.

The sum of the ranks ranged from 30 (the sample judged best) to 99. The grouping of these sums of ranks was as follows: 30-39, two samples; 40-49, one sample; 50-59, five samples; 70-79, two samples; 80-89, one sample; 90-99, two samples.

The five samples ranking lowest (sum of ranks 70 or above) seem either antiquated or mistaken. Even the sample judged to be the third best (sum of ranks, 45) is not exactly true throughout.

It is my opinion that the scale represents the book fairly well and that only the best three or four samples are good enough to include in an educational psychology. There is, however, no measure of the degree in which the scale is justly representative; the judges are few; and there are no compari-

sons with other books. Even with these and other weaknesses this measurement is probably more valid and more reliable than my unsupported judgment.

JOHN P. HERRING

State Department of Institutions and Agencies, Trenton, N. J.

HAWLEY, HATTIE L. *Teaching English in Junior High Schools.* Boston, Houghton Mifflin Company, 1924. 136 pp.

As the first book in its special field, Miss Hawley's rather slender monograph is not bad—perhaps we should say good. There is probably not a single statement in the book which the progressive and well-informed teacher of English would wish unsaid. Its weakness lies rather in its omissions.

The values of motivation and socialization in the teaching of English are quite soundly set forth. The author emphasizes especially the importance of developing the pupils' initiative by giving them a chance to help plan and conduct their own recitations. She emphasizes the usefulness of definite assignments, but perhaps exaggerates the degree of interest which is excited by the pupils' exact knowledge of just what they are to do. The last third of her book, which is devoted to devices for fixing facts, is the most original and, therefore, to well-posted teachers, the most valuable. The first two-thirds of her pages deal with more important matters, but only repeat, without especial freshness, ideas which pervade all enlightened discussions of the teaching of English. In the spelling devices, in her new form of inductive method in punctuation, and in the guidance of her pupils to help each other by questioning, she is either breaking new ground or walking in a very freshly turned furrow.

The faults of the book are quite as obvious as its merits. The distinction between the devices to cultivate appreciation and those to cultivate power is a very doubtful one, and the fact that some procedures are described in both chapters indicates that the distinction was not clear even in the author's mind. Many of the points made in one chapter might equally well be in the other. Still more serious is the fact that many of the illustrations of principles are drawn from the work of the senior high school instead of the newer institution. In fact, the great weakness of Miss Hawley's effort is that she has given us no distinct discussion of the peculiar institutional and psychological conditions under which instruction in the junior high school proceeds. For this reason most of her devices would apply equally well to the fifth grade or to the eleventh. We must hope that soon some active teacher in the junior high school—Miss Hawley belongs to a high school of commerce—will give us a first-hand exposition of the special characteristics of junior high-school English. Minor faults are the confining of all language and grammar drills to the correction of errors and the recommendation of too many detailed questions in literature which throw the emphasis upon memory rather than upon appreciation. On the whole, literature is given much less attention than it undoubtedly deserves in a book with this title.

Teaching English in Junior High Schools will be valuable chiefly to the teachers who are promoted from the grades to the junior high school and who

want some orientation in secondary-school methods, many of whom need to have their viewpoints modernized.

N. W. WILBUR HATFIELD

Chicago Normal College

HUNT, CHARLES W. *The Cost and Support of Secondary Schools in the State of New York.* New York, Macmillan Company, 1924. 107 pp. (A Report Reviewed and Presented by the Educational Finance Inquiry Commissioner under the Auspices of the American Council on Education, Washington, D. C.)

This report on school costs is the third study in the series of thirteen which is prepared under the auspices of the Educational Finance Inquiry Commission and is also one of three devoted to the study of school finance in the State of New York.

As indicated in its title this is a cost study. It covers the field of secondary education only and for the decade 1910-11 to 1920-21. It is devoted to two main lines of inquiry: What do the schools cost? and, What are the influences of certain factors that are generally assumed to have a bearing on costs? Incident to the pursuit of this investigation, because of the form in which financial records had been kept in the state, it was necessary to devise a means of separating high-school costs from total school expenses. To accomplish this the Teachers' Salary Ratio Formula was worked out. It was only by use of the formula

$$\text{Total current expense for schools} \times \frac{\text{Secondary teachers' salaries}}{\text{Total teachers' salaries}} = \text{Total current expense for secondary schools,}$$

the validity of which is shown.

The data for the study have been selected and treated with care, the report is well organized and, though one might wish for a little fuller treatment at some points, the findings are in the main clearly presented. Although it would have added to the volume of the report, it is regretable that per-teacher costs were not presented along with the per-pupil costs. For what was attempted, however, this is a report that will be useful throughout the country as well as in New York State.

The actual findings present few surprises. These are: (1) Wide variations in costs for schools of all sizes and classes exist, but they are wider for small than for large schools. (2) Per-pupil costs doubled within the decade studied, the increases for salaries came later and those for cities did not keep step with increases for other items. (3) There was extremely wide variation among districts in the percent of current school expenses which went for high schools. (4) The amount of wealth except in three- and four-year union schools, furnished no indication of the size of contribution to support by the local district; wide variation in cost for each of the subjects taught. (5) Throughout there is is evidence of urgent need for some effort at standardization in high-school costs, and also for a more scientific system of accounting. In all these points, as well as in the many valuable by-products of the study, the results confirm what other studies have brought to light.

One cannot read this report or any of the companion reports of the series without being impressed with the unsatisfactory condition of our financial records and with the utter lack of evidence of any well-coordinated and clearly thought out policy for financing our scheme of public education. Such studies as this will furnish us with new bases of criticism and force us to question, not only our general governmental policy affecting schools, but also our organization, our curricula, and our buildings from a standpoint that must ultimately play a part in directing education.

JESSE B. SEARS

Stanford University

Publications Received for Review
February 15-March 15

ANDRUS, RUTH. *A Tentative Inventory of the Habits of Children from Two to Four Years of Age.* New York, Teachers College, Columbia University, 1924. 50 pp. (Teachers College, Columbia University, Contributions to Education, No. 160.) Cloth, $1.50. Paper, $1.25.

BRYCE, CATHERINE T. *Language Training in the Primary Grades.* New York, Newson and Company, 1924. 245 pp. $.80.

DEARBORN, NED HARLAND. *An Introduction to Teaching.* New York, D. Appleton and Company, 1925. 337 pp.

GESELL, ARNOLD. *The Mental Growth of the Pre-School Child.* New York, Macmillan Company, 1925. 447 pp. $3.50.

GOODSPEED, THOMAS WAKEFIELD. *The Story of the University of Chicago, 1890-1925.* Chicago, University of Chicago Press, 1925. 244 pp.

HOTCHKISS, E. A. *The Project Method in Classroom Work.* Boston, Ginn and Company, 1924. 258 pp. $1.48.

KYTE, GEORGE C. *Reorganization and Administration of an Elementary School to Meet the Needs of a Community.* Berkeley, California, University of California Press, 1925. 144 pp.

LIGDA, PAUL. *The Teaching of Elementary Algebra.* Boston, Houghton Mifflin Company, 1925. 256 pp. $1.90.

MARSH, HARRY B. AND VAN SICKLE, JAMES H. *The Pilot Arithmetics.* New York, Newson and Company, 1923. Book II. 336 pp. $.80. Book III. 347 pp. $.88.

REAVIS, WILLIAM C. AND OTHERS. *Studies in Secondary Education, II.* Chicago, University of Chicago, 1925. 202 pp. (Supplementary Educational Monographs, No. 26.) $1.75.

REEVES, CHARLES EVERAND. *An Analysis of Janitor Service in Elementary Schools.* New York, Teachers College, Columbia University, 1925. 194 pp. (Teachers College, Columbia University, Contributions to Education, No. 167.) Cloth, $1.50. Paper, $1.25.

RUSSELL, WILLIAM F. AND OTHERS. *The Financing of Education in Iowa.* New York, Macmillan Company, 1925. 279 pp. (Report of the Educational Finance Inquiry, Vol. 8.) $1.00.

SEARS, JESSE B. *The School Survey: a Textbook on the Use of School Surveying in the Administration of Public Schools.* Boston, Houghton Mifflin Company, 1925. 440 pp. $2.25.

SOLTES, MORDECAI. *The Yiddish Press, an Americanizing Agency.* New York, Teachers College, Columbia University, 1925. 242 pp.

STEVENS, LOU BELLE. *Drill Cards, Foundation Number Work.* New York, Newson and Company, 1917-1923.

STEVENS, LOU BELLE AND VAN SICKLE, JAMES H. *The Pilot Arithmetics.* New York, Newson and Company, 1923. Book I. 272 pp. $.80. Teachers Manual. 256 pp. $.64.

THURSTONE, L. L. *The Fundamentals of Statistics.* New York, Macmillan Company, 1925. 237 pp.

News Items and Communications

This department will contain news items regarding research workers and their activities. It will also serve as a clearing house for more formal communications on similar topics, preferably of not more than five hundred words. These communications will be printed over the signatures of the authors. Address all correspondence concerning this department to Doctor E. J. Ashbaugh, Ohio State University, Columbus, Ohio.

The University of Iowa Service Bulletin of February 7 is devoted to *Recent Textbooks for Spanish.* These books are discussed under the headings composition and conversation, grammars and elementary books, readers and anthologies, and reading texts.

The Public School Publishing Company reports the participation of over 300,000 pupils in their nation-wide survey of pupils' achievements in English composition through the use of the Pressey Diagnostic Tests in English Composition. Nation-wide medians with more than 130,000 pupils for each test have been computed.

Dr. Hollis Dann, formerly Supervisor of Music for the Pennsylvania State Department of Education, became Head of the Department of Music Education at New York University on February 1. Dean Withers of the School of Education believes that the appointment of Dr. Dann is another step toward the realization of a comprehensive program of development now under way at this university.

Mr. L. W. Reese, Bowling Green, Ohio, for some time an Assistant County Superintendent, has recently published a score card for selecting school sites for rural consolidated school buildings. A selection of sites is usually a difficult problem for school boards, any assistance which can be rendered them is worthy of consideration.

The Committee of the Michigan State Teachers' Association whose admirable report, *Uniform Child-Accounting,* attracted so much favorable comment has completed another piece of work *Uniform Financial Procedure for the Public Schools of Michigan.* This pamphlet (Bulletin No. 4, Part I) may be secured from the Committee on Uniform Child-Accounting and Unit Costs at Lansing.

Denver has, during the past year, been prominently in the limelight because of its scientific study of curricula. The schools have received enthusiastic newspaper publicity. A number of the articles have recently been brought together in a pamphlet which should be of great interest to school administrators everywhere.

The Western State College of Colorado, at Gunnison, will hold their Third Annual Contest of High-School Scholarship on May 8. The contest will include: algebra, Latin, American history and civics, physics, English language, and general information. These scholarship tournaments at several of our mid-western teachers' colleges are reacting most helpfully upon the work both of the secondary schools and the teacher-training institutions in the districts interested.

We have commented from time to time on the supervisory work of the State Department of Education of Alabama. The report of their Annual Conference of Elementary Supervisors contains much concrete assistance. Instructions to new supervisors, plans for effecting reorganization on the 6-3-3 basis, and some objectives in supervision for the year are the main topics discussed.

The February issue of the *Education Bulletin of New Jersey* gives the following apportionment of the tax dollar in the state for 1924: Municipal government, 39.1 cents; education, state and local, 32.2 cents; county government, 16.7 cents; and state government, 12 cents. The per capita total cost given is sixty-one dollars.

The Bureau of Educational Reference and Research at the University of Michigan has recently published three bulletins under the same date: *Permanent Effects of Teaching of Spelling, Results Obtained from Ability Grouping*, and *Results from Successive Repetitions of Certain Arithmetic Tests* (Bulletins Number 71, 72, 73). Each is a report of a cooperative study by school people of the state under the direction of Dr. Clifford Woody, the director of the Bureau.

The preliminary reports in a survey of school-building costs in New Jersey indicate that the median cost for high-school buildings erected during the last four years has been approximately $529 per pupil. Elementary schools of larger size have cost about $335, and smaller schools, $264. The corresponding figures for the median cost per square foot have been $12.44, $11.97, and $7.99 for the three types respectively.

Mr. Russell Doney, director of the Kalamazoo, Michigan, Research Department, gave a triple test of spelling to the junior high schools at the close

of the first semester this year. Test I covered the words taught during the semester which was just closing; Test II, the words from the Ayres-Buckingham Spelling Scale; and Test III, the words to be taught during the second semester. Test II may be of interest as a survey proposition, but Tests I and III ally themselves directly to classroom work. The success of the work in spelling by both teachers and pupils can only be measured in terms of the specific subject-matter which has been the subject of study and teaching, while the preliminary test which points out the pupils' needs is also coming to be recognized as important schoolroom practice.

The National Committee for the Prevention of Blindness has selected Cincinnati as its center for the training of teachers and supervisors of sight-conservation classes. A complete program of instructional, observational, and clinical work will be offered at the University.

Dean Athearn of the School of Religious Education, Boston University, has announced the following bulletins available on request:

Athearn, Walter S. *An Evaluation of the Project Method as an Instrument of Religious Education.*

Bentley, John E. *The Mechanistic and Personalistic Psychological Contributions to the Field of Religious Education.*

Marlatt, Earl. *What Is a Person?*

Munkres, Alberta and Others. *Bibliography for Elementary Workers in Religious Education.*

The American Federation of Arts at its last convention adopted a suggestion made by Mr. Huger Elliott, principal of the Pennsylvania Museum and School of Industrial Art, to the effect that the greatest service in the field of art that could be rendered by a great national organization would be to "see that every school in the United States from the Metropolitan high school to the smallest school in the backwoods, has upon its walls at least one plaster cast of a superb piece of sculpture and one fine color print of a masterpiece of painting." The federation is appealing to its chapters and members to endeavor to carry out this idea.

In accordance with a plan which is being used by a number of educational institutions during their summer sessions, the University of Cincinnati has organized composite unit courses, which will be given by the following persons: Charles L. Spain, deputy superintendent of schools at Detroit, Michigan; Bird T. Baldwin, director of the Iowa Child Welfare Research Station; James M. Glass, director of junior high schools in Pennsylvania; Rena Stebbins, instructor in educational measurements at the Rochester City Normal School. The first three will be present for one week only during the term, June 22 to July 31.

Reducing the Element of Chance in Intelligence Tests

Intelligence tests commonly contain a large amount of multiple-choice material. In this type of exercise, both right and wrong answers are printed on the test sheet, and the person who is being examined must indicate in some way the correct ones. The following are examples from well-known tests:

Otis Self-administering Test, opposites—
The opposite of hate is (?)
1 enemy, 2 fear, 3 love, 4 friend, 5 joy.....( )

Terman Group Test, disarranged sentences—
true bought cannot friendship be.....true false

National Intelligence Test, information—
A duet is sung by *one two four six*

It is well recognized, of course, that chance may play a part in material arranged in this way. If one is compelled to guess, the answer may be right or wrong. Moreover, chance does not have the same effect on the scores of different individuals or of the same individual at different times. The result is the introduction of an element of unreliability.

In the March, 1924, number of the *Journal of Educational Research* (p. 240) Asker has an article on the "Reliability of Tests Requiring Alternative Responses," from which the following statements are quoted:

> But when part of the test is known, and the rest is answered through guessing, there are rather large chances both for undeserving individuals to make a passing grade and for deserving pupils to fail. Especially is this true in the case of a test with only two possible answers.
>
> Tests of this kind possess, however, so pronounced advantages in many respects over the traditional examinations, that they undoubtedly will come into more general use, in spite of the attacks that are sometimes made upon them. But a more reliable method of scoring must be found.

An experiment has been conducted recently by the writers to find out whether the material of the test itself might not be arranged so that the element of chance would be greatly reduced without at the same time destroying the value of the material for intelligence testing. Types of material in common use were selected for the experiment. Examples of the arrangements used are given below. In each case the task of the examinee was to write the answer as a single word or a number in a blank at the right of the page.

(1) Arithmetical reasoning.—
How many are ten pennies and five pennies?..... .....
(2) Information.—What day comes just after Monday?.... .....
(3) Opposites.—What word means the exact opposite of good? .....
(4) Analogics.—Girl is to woman as boy is to (what?)..... .....
(5) Disarranged sentences.—The words below are mixed up. They would make a question if they were put together in the right order. Think to yourself the question they would make, and then write the one word that will answer it. *Breathe what do we?*.... .....

Other types such as number of series, reasoning, classification, synonyms, logical relation, and word comparison were arranged in a similar manner. A self-administering test was devised from this material, and no word or phrase was used to classify the items. It is obvious that in exercises like the above the possibility of getting a correct answer by pure guessing is very small.

The amount of material available for the arrangement illustrated above is somewhat less than that which may be employed in the ordinary method. This restriction, however, does not apply to all types of material. The expedient of increasing the number of items from which choice must be made may be used upon almost unlimited material. The number of arithmetical examples in which no answer at all is given on the test sheet may likewise be increased indefinitely. Owing to the large number of synonyms in the English language and the difficulty of framing questions to which only one correct answer can possibly be given, however, the material which may be used in opposites, information, analogies, and disarranged sentences is much less in the arrangement suggested above than in the multiple-choice examination.

In this experiment two tests of sixty-seven items each were made from material of the kind illustrated above. These tests were then tried out on pupils ranging from seven to twenty-one years of age to determine whether the new material possesses the characteristics usually demanded of group intelligence tests. The outcome proved very encouraging.

Coefficients of correlation of the two forms of the test ranging from 0.92 to 0.99 (P.E. 0.02), and of the new test with the Terman Group Test of Mental Ability ranging from 0.59 to 0.71 (P.E. 0.02 to 0.10) suggest a high reliability and validity. The new material is well adapted to group use. The element of writing does not seem to be a serious objection, particularly since the new arrangement seems exceptionally well suited to a "power" rather than a "speed" test. Pupils may be expected to break off making correct responses much more abruptly with this type of material than with the multiple-choice arrangement.

The material fits a wide range of intelligence, though it is probably better suited to the upper ranges than to the lower. It can be used successfully, however, as low as grade IV.

Administration of a test of this type is no more difficult than that of the ordinary group tests, and scoring is simple and objective. Exact answers are given by a key that lies just beside the answers in the test. Furthermore, there is no subtracting of wrongs to confuse the scorer.

In conclusion, the authors wish to register their belief that in the future development of standardized tests serious attention needs to be given to improving their technical qualities. The instruments which resulted from our early experimentation must be carefully revised or give place to others that will be developed. Among the characteristics that need to be considered is reliability as it is affected by the construction of the test itself. This experiment has suggested a possibility of decreasing the element of chance by certain types of arrangement of commonly used material. It is easily possible to construct an intelligence test without using the ordinary multiple-choice arrangement, or to increase the number of possible choices so that the chances of a correct answer through guessing are negligible. The principle is also applicable to the construction of an achievement test.

T. E. DUNSHEE
H. T. MANUEL

Western State College of Colorado

Dean L. A. Pechstein of the College of Education at the University of Cincinnati has just brought to completion a five-year course for prospective teachers of public-school art, jointly sponsored by the Cincinnati Art Academy and the University. It is coordinated with other five-year programs of the College of Education and is based upon the Cincinnati plan of cooperative teacher-training. The first two years are spent in technical instruction in art in the Art Academy. The remaining three provide an abundance of liberal arts and education courses as well as detailed instruction in the field of public-school art. The last year is devoted to part-time cooperative student teaching with pay in the city schools and to advanced work in education. Graduates of these programs receive preferred appointment in the Cincinnati schools, state certification, and approximately half of the requirements for the degree Master of Arts.

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